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ORIGINAL COMMUNICATIONS.

On the Structure *and* Growth *of the* Ovarian Ovum *in* Gasterosteus leiurus. By W. H. Ransom, M.D.

(Read at the Meeting of the British Association in Nottingham, 1866.)

I purpose to speak in this paper of some points upon which I have been led to adopt conclusions at variance with those generally accepted on the mode of growth and structure of the early vertebrate ovum, not to discuss the whole question.

It is remarkable at how early an age the ovaries are found to contain perfect young ova. Fry of $\frac{1}{2}''$ in length, and not more than one month old, have well-developed ova in their ovaries, and the young males are even more remarkable in respect of the early development of the male gland, in which actively moving spermatozoids are found when the fry are not above 1″ in length.

The germinal vesicle, which is always present in the earliest recognisable ova, contains, besides the germinal spots, a delicate translucent colloid mass, which, like a pellet of thick mucus, supports and gives great resisting power to the vesicle. From very various and not clearly ascertained causes, a fine molecular deposit, easily dissolved by weak solutions of alkaline chlorides, is apt to appear in the colloid mass.

The germinal spots are embedded on the surface only of this colloid mass, and lie in contact with the inner surface of the vesicular wall. They are very sensitive to the influence of the medium in which they are examined, so much so that it is extremely difficult to observe them in a perfectly unchanged condition. This can be done, however, by using the maternal secretions, or by employing only a very small amount of water, and using all possible speed in the prepara-

tion of the object. They are then seen as circular objects, perfectly homogeneous and of moderate refractive power. (See Pl. .I Fig. 1.) They are acted upon by water in a remarkable manner, varying with the quantity. Thus, if water approaches the germinal spots only after having had to traverse a portion of the egg, as happens in unbroken eggs, it slowly dissolves them, at the same time causing the appearance of fine granules in the colloid mass. But if water in abundance acts upon the germinal spots contained in escaped germinal vesicles, or on the vesicles within very minute ova before the food yelk is formed, it causes them to become dark-bordered, variously tailed in shape, vacuoles appearing at the same time, and does not dissolve them even after very prolonged action. (See Figs. 2 and 3.) At the same time it produces a change in their substance or surface, as a result of which they are rendered insoluble in 5 or 10 per cent. solutions of alkaline chlorides, although the spots of freshly escaped vesicles are rapidly soluble in the same fluids. A weaker 1 per cent. solution of chloride of sodium acts like water on the germinal spots of freshly escaped vesicles; but after about an hour they resume the round form, and the idea is thus suggested that they may be capable of contractions like those seen in white blood-corpuscles.

The disappearance of the germinal spots of vesicles contained in the larger eggs, when exposed to the action of water, appears to be due to the solvent action of the saline or other constituents of the yelk carried through by endosmose.

The germinal spots of recently escaped vesicles when acted on by a 5 per cent. solution of chloride of sodium, flow together and fuse into a larger drop, and ultimately the large drop gets paler, vacuolates, and vanishes. (See Fig. 4.) I conceive the spots to be drops of a thick fluid, having a composition different from all the other structural elements of the egg, and resembling the other varieties of protoplasm only in their extreme instability and liability to vacuolate.

The vesicular wall was found to be remarkably stable and firm; it was dissolved, however, by a weak solution of ammonia. Were it not for the resistance afforded by this membrane, the disappearance of the germinal spots in the osmotic current of water charged with the salts of yelk might suggest a plausible explanation of the ultimate disappearance of the germinal vesicle and contents, in the ripe ovarian ovum.

I will not prolong this paper by describing in detail the yelk of ovarian ova, but only mention that the primitive yelk differs in chemical and physical characters from either the

food, or formative, yelk of ripe eggs, and is remarkable for its solidity.

The yelk-sac is formed in very young ova, and is separable in those measuring $\frac{1}{200}''$ in diameter. It is then easily recognised by the little button-shaped processes or villi attached to the outer surface of its germinal segment surrounding the micropyle. The finely-dotted structure was made out in the yelk-sacs of eggs, measuring $\frac{1}{140}''$. The prevailing opinion among physiologists seems to be that the yelk-sac is formed at a much later stage of the development of the egg. That this is not so in osseous fishes is easy to prove; it remains to be seen whether they are exceptional in this respect.*

The peculiar structure of the yelk-sac, which is the same in the youngest ova as in the ripest examined, offered facilities for inquiring into its mode of growth.†

Thus, in young eggs measuring $\frac{1}{100}''$ in diameter, the yelk sac had 24,000 dots to the inch, while in ripe eggs measuring $\frac{1}{17}''$ but 11,000 dots to the inch were present, the egg increasing about six times in diameter; the interval between the dots but little more than doubling. As the size of the dots had increased but little it is certain that during growth there must have been an increase in the number as well as in the size of the dots, which we may speak of as structural elements of the yelk sac.

Again, in young eggs about $\frac{1}{100}''$ to $\frac{1}{80}''$ diameter, the number of buttons on the outer surface is on an average of five countings 80. In ripe ovarian ova there are on an average 207 buttons on the outer surface of the yelk-sac. It is, therefore, not conceivable that the mode of growth which has hitherto been accepted for cell-walls and yelk-sacs can be

* Owen ('Comparative Anatomy and Physiology of Vertebrates,' vol. i, pp. 593 and 594) speaks of a yelk-membrane, distinct from the dotted sac, or "Ectosac," and he refers to figures of Dr. Allen Thomson's, incorrectly attributing them to me. I cannot confirm the view thus stated, and believe the figures to be wrongly interpreted. The "Ectosac" is a true yelk-sac. It does not, as Owen states, receive its villi after the escape of the ovum from the ovisac, nor does the escape take place, as he also seems to think, before the ovum is ripe. The interesting question of the homologies of the yelk-sac in Vertebrates is probably not yet settled, but the dotted sac of osseous fishes is certainly homologous with the structureless yelk-sac of Batrachia, and, like it, is early formed in the ovisac, and lies in direct contact with the mass which cleaves after impregnation.

† The membrane may briefly be described as composed of very fine concentrically-arranged laminæ. Each layer is marked by dots arranged alternately so as to mark the angles of lozenge-shaped spaces. In the separate laminæ the dots correspond to each other in such a manner that they form lines or striæ, vertically placed in the substance of the yelk-sac; and whether examined on the outside or inside of the yelk-sac, are equal in size and distance from each other. (See Fig. 5.)

in action in these ova. No growth by opposition of layers, either from the inside or outside, either by hardening of an exudation from, or by conversion of the substance of the yelk into that of the yelk-sac, can explain the increase in number and size of the buttons on the outer surface, and of the dots in the substance of the yelk-sac. There are other difficulties against the acceptance of the usually received view, which will at once occur to any one who considers the arrangement of the dots and laminæ; but I have said enough, I think, to justify the inference that the dotted yelk-sac of osseous fishes grows in some way by interstitial molecular deposit. This view I am disposed to extend to other analogous tissues, perhaps to the so-called intercellular matrix of cartilage.

A word or two on the methods which this sort of inquiry demands. A medium is wanted which separates the different objects, and is as far as possible without influence on the optical or other properties of the tissue. But such a medium is, perhaps, unattainable, as each part of the egg differs from the other in its reactions to media. On the whole, the best fluid in which to conduct an examination of this kind is a weak solution of glycerine, such as is found by experiment not to alter the aspect of the red blood-corpuscles of the animal. The plan of staining tissues by carmine suggested by Dr. Beale is not to be recommended; for the ammonia rapidly dissolves the germinal vesicle and its contents, and the acetic acid glycerine obscures the finer markings upon the yelk-sac, as well as deforms the yelk. Moreover, I may mention that the granular formative yelk takes the dye with greater difficulty than the yelk-sac does, except in very young ova, and the inner sac, a true germinal matter, does not take any stain; so that I cannot accept the staining of certain parts of a structure as satisfactory evidence of the distribution of germinal matter in the tissue.

On Fresh-water Algæ, &c.

By Dr. J. Braxton Hicks, M.D., F.R.S., F.L.S., &c.

My principal motive in remarking on Mr. Archer's paper on *Palmoglœa macrococca* was not so much to question the independent existence of the forms of which he wrote, as to urge him to direct his unfettered attention to the study of

these forms in their life-history; and also to rouse the attention of Algologists to the unstable basis on which the genera of so many of these lower forms were resting. I am glad to find that, to a considerable extent, Mr. Archer agrees with the observations then made, though he appears yet to hold that there are some plants which can always be recognised by the eye, although it is difficult to convey the exact appearance by word or drawing. No doubt this is so; but yet it must be admitted as a very insecure basis on which to stand.

A few points yet remain on which we differ, upon which I should wish to make a few remarks.

1st. Admitting that the disposition of the endochrome in a given cell, found at a certain time, is precisely the same as that in another found at another time, so that we all at once recognise it as identical in appearance, yet such constancy and similarity does not *prove* them to be the same species or genous, only that at a certain phase of their existence they always assume the same appearance, and indeed, for anything we know to the contrary, unless observed very constantly and under other circumstances, they may have an essentially different origin. The arrangement of the endochrome is very variable, perhaps more so than any other feature, during the various periods of growth and division. Thus it becomes stellate in certain of the segmenting cells of gonidia of prasiola; in other stages it is quite homogeneous; while in its lyngbya stage it is often with many vacuoles. But numberless examples can be quoted.

2nd. Mr. Archer relies much on the shape of the cell to distinguish species; but here I must reiterate my remarks, and ask, if during the processes of growth and division, a single-celled plant is sometimes oval, at another round, as is undoubtedly to be found in the segmenting gonidia of the lichens and mosses, how can he hold it as more than a proof of its being in a certain stage of its life? With regard to the resemblance of certain cells, nothing could be more like the elongated oval cell of *Palmoglœa cylindrocyotis* or *Brebissonii* than some of the segmentations of gonidia or cladonia. They were at the time I observed them merely smaller than the full size of the former. That they arose from cladonia was clear; yet, had it been found developing on the ground it would have been doubtless referred to *Palmoglœa Brebissonii*. Now it must be admitted, either that the observations were erroneous, or that the *Cladonia gonidium* so resembled *Palmoglœa Brebissonii* as not to be capable of being distinguished; at any rate, at that particular stage of their life. If the latter is accepted, then what proof have we of the separate exist-

ence of *Palmoglœa Brebissonii* by its form alone? At the same time I am not disputing the separate existence of these two plants. If, however, it could be certainly shown that the cladonia form never conjugated, then it must be admitted that they were essentially distinct; but in this case our knowledge is arrived at by the study of the life-history and not by the appearance. The form of the cells, and the disposition of the chlorophyl in *Palmoglœa Brebissonii* throughout the mass at the period of conjugation, varies much, some of the cells being scarcely oval, while the length of others exceeds three or four times their breadth. Mr. Archer also is disposed to think that I confound chlorophyle-bearing plants with those having phycophyle; and as a ground for this, he cannot conceive of one being produced by the other. In answer to this I may say that there are many instances to be found; of their mutual exchange so much so as to do away with the value of this distinction of colour. Instances may be found repeatedly in Collema, particularly during the segmentation of the gonidia, and their change into nostoc; the transition is gradual in the various periods from the true chlorophyl to the phycophyle. A distinct change from bright green to leaden blue may be observed during the segmentation of the gonidia of the confervoid filaments on barks of trees, as already slightly alluded to in my paper in 'Linnæan Trans.' on this subject. Many other instances of this occur, so that it is impossible to lay much stress on this point.

Again, Mr. Archer thinks that the maintenance of the characters in these simple forms in diverse circumstances and places as a proof of the fixity of a large number of species which he quotes, and has a difficulty in imagining how a Lichen or Moss-gonidium can readily be conceived to change now into one form, and now into another. But nothing is easier to conceive than that simple gonidia from many sources do divide and grow into these forms; that it is the ordinary law of their growth; and that many of these forms, apparently somewhat dissimilar in external form and internal arrangement, can and do spring from the same source, and that it is their ordinary mode of so doing. If this be received the rest is simply a matter of observation. If the life-history shows it, we are bound to accept it, whether according to preconception or not. And it must not be forgotten that my observations extended only to a few species, and yet in them there is considerable variation in form and shape. It must also be noted that I do not say all the Palmellaceæ and kindred forms arise from Cladonia. I only show a great many do, and also that similar forms spring from mosses

upon which I ask, What about the rest? How can they be considered really distinct, unless you now go over the whole, and prove them one or the other? I do not absolutely deny their separate existence, but I do say here is enough evidence to set us to work again to study the life-history of each; and certainly, till each one is again worked out, we cannot (notwithstanding all our affection for our old acquaintances) consider any one as finally placed.

But Mr. Archer relies most (talking of *Palmoglœa Brebissonii*) upon the fact of conjugation as the most certain test of the fixity of species, believing it as the analogue of pollen-impregnation, and therefore as showing the maturity of the cells in which it occurs; any cell therefore conjugating he looks upon as the perfect form of it. We must doubtless admit that this process is one of considerable character, and an important phase of the life of the cell; and also that, traced downwards, there is something in the analogy to favour this conclusion which is shared by many. Yet I may ask, without going into the whole question, looking at the process itself, have we any direct evidence that it is anything more than a direct fusion of the contents of two cells? Whilst admitting the value of the analogy, ought we to ascribe more value to the act than really appears? What, for instance, is it in Spirogyra? A process of one cell joins with the process of another, and their contents thus being able to come into contact, fuse into one mass. Before the change began it was impossible to perceive any difference between the two cells. Further than this, we often find in some species that should no second filament be near enough, the two adjoining cells of the same filament conjugate by throwing out processes round the joint which divides them, and then their contents fuse. In *Palmoglœa Brebissonii* not the slightest difference can be perceived between the two cells. Mr. Archer admits this, though in some few he has noticed a difference between the conjugating cells, as if an approximation was being made to the antheridal cell. Still, upon the whole, they are both apparently similar. Therefore setting aside analogy, but stating the case as we actually observe it, we cannot but call it an act of simple fusion of the contents of two cells. Are we justified in our present state of knowledge in placing so much importance upon it as to make it a test of the most perfect condition of the cell? To do so at present would be arguing somewhat in a circle. For our safe advancement it seems to me best not so to use it, but merely to note the fact and the mode in which it occurs, reserving its use as a test when we have advanced further in knowledge. Some day

it may take the position Mr. Archer and others have assigned it.

At present, on the other hand, we know that the contents of cells fuse readily under certain circumstances; and other cases may some day be found which may solve the question where this process and antheridia are plainly found. For supposing it was ultimately found that Spirogyra *has* Antherozoids, then we must agree that conjugation is nothing more than a vegetative process. This hitherto has not been noticed; but we are hardly in a position to say that it will never be so. Till then we shall, I conceive, advance quicker if we do not assign conjugation a too definite position.

Finally, Mr. Archer asks, "Can a phenomenon which has been going on for years and years uncountable, be simply accidental, and devoid of significance?" This question is scarcely pertinent, because I have never said it was a simple chance occurence, but have placed it with other vegetative processes, such as segmentation, &c. As to the antiquity of the process the same of course may be said of ordinary growth or cell-division. That conjugation restores the vigour of the plant enfeebled by frequent division can scarcely be doubted, and that it is of much value in its life. I do not for a moment deny, but I do not think that we are yet warranted in employing it as a test of generic or specific distinction, because it is very doubtful whether it is an evidence of the perfectness of the cells in which it occurs, and because we are still ignorant to what extent it may be found in the lower tribes; nor are we yet sure that plants, which we know show it most distinctly, have not at some period of their life the true antherozoids.

On Pleurosigma, Donkinia, Toxonidea, *and* Amphiprora. By T. P. Barkas, Newcastle-on-Tyne.

(Read before the Tyneside Naturalists' Field Club, February 8th, 1866.)

It is my intention this evening to direct the attention of the members of the club to four closely allied genera of diatomaceæ which have recently been found on that part of the Northumberland coast which is in close contiguity to the Mouth of the Tyne. Two of the genera are well known to microscopists; one has only recently been discovered and named by Dr. Donkin, and the other, which was discovered

by Dr. Donkin, and enrolled by him among the Pleurosigmata, was finally constituted into a new genus, and named by Mr. Ralfs, Donkinia, in honour of its discoverer.

All the four genera belong to the family Naviculeæ, in which family there are already nineteen genera.

I propose to select this evening the following for observation, Pleurosigma, Toxonidea, Donkinia, and Amphiprora, as they are nearly related, and bear in many respects a considerable resemblance to each other, in one or more of the aspects in which they may be viewed.

They are all free forms, and are found on our own coasts; some appear to be peculiar to the Northumbrian shores, as up to the present time they have either not been found at all in other parts of the kingdom, or found so rarely as to render it probable they were there as stray frustules rather than that they were in their natural habitats. Evidence of this, however, is only negative, and negative evidence is always doubtful.*

The mode of gathering diatoms from the open sea-shore adopted by Dr. Donkin, Rev. Mr. Taylor, Mr. Atthey, and others, has now been before the world for eight years, and yet nothing approaching the work done by the gentlemen just named has been accomplished in any other parts of the kingdom; even the indefatigable Mr. Norman, of Hull, has not found on the Hull coast any of the Toxonideæ, or Amphiproræ, only a few of the Pleurosigmata, and not a single frustule of Donkinia, the whole of which genera abound on the Northumberland coast, extending from the mouth of the Tyne to Alnmouth.

Many of the Pleurosigmata, and some of the Amphiproræ and Donkiniæ are found nearly as far up the beach as high-tide mark, but Toxonideæ I have only found near low-tide margin. The four genera are characterised by having flexed median lines, by central and terminal nodules, and by being more or less strongly striated, the striæ in some being very coarse and broad, and in others so delicate and close as to be visible only by the highest powers and most careful illumination.

This evening I propose to bring before you *eighteen species* of Pleurosigma; eight of which are well-known, six of which are doubtful, and four I have good reason for believing are new and undescribed. With respect to the doubtful and the unknown it would be unbecoming to dogmatise, as some of the forms so closely approximate, and the differences which form species are so minute as to render the most careful

* Since this paper was read, I have received slides of all the four genera from both the south and west coasts of England.

examination necessary before a decision can be arrived at as to their newness.

I shall be happy to exhibit the new and doubtful forms to those members of the club who are acquainted with marine diatomaceæ, and their opinions will be esteemed a favour.

The Pleurosigmata are characterised by a more or less naviculoid form when seen on the *side view*, and linear lanceolate form seen on the *front view*. The front views of the Pleurosigmata, like the front views of the Toxonideæ, are only seen when the frustules are alive and moving in water, on which occasions they frequently roll over in such a manner as to exhibit the front views of the frustules, but of the thousands of frustules of Pleurosigma and Toxonidea which I have prepared and mounted I do not remember one in which the front view is exhibited. That is not the case with Donkinia and Amphiprora, as by their peculiar conformation they as frequently when prepared and mounted dry present their front aspects as those of their sides.

Of the genus Toxonidea, so named by its discoverer in consequence of the median line resembling a bow, there are only *three* known species, *T. Gregoriana*, *T. insignis*, and *T. undulata;* the two former have been found on the Northumberland coast, where they are very numerous, as may be seen by examining the cabinets of Dr. Donkin, Rev. Mr. Taylor, Mr. Atthey, or that in my possession; all the microscopists named have gathered them from the Northumberland shores in very great numbers. *T. undulata* has not been found in this neighbourhood, but was obtained by Mr. Norman, of Hull, from the stomachs of Ascidians got by fishermen off the coast of Hull.

Pleurosigma and Toxonidea are somewhat similar in the flexure of their median lines, and yet more closely resemble each other in the naviculoid forms of their front views.

The frustules of Donkinia are exceedingly abundant on all parts of the Northumberland coast; they are obtainable at the mouth of the Tyne, on the Long sands and Whitley sands, both near high-tide mark and at the low-water zone; with the exception of *Navicula gregaria*, *Cocconeis excentrica*, and *Attheya decora*, they are the most common local marine forms.

They have flexed median lines similar to the Pleurosigmata, and recognised by their side aspects only; their discoverer ranked them among the Pleurosigmata, from which genus they differ entirely in their front views, as they do also from Toxonideæ, and more nearly resemble the Amphiproræ, the only difference being the presence of alæ in the Amphiproræ and their absence in the Donkinian frustules.

The diatoms of this genus in consequence of their forms present when mounted their fronts as frequently as their sides, as may be seen by reference to any slides containing specimens of the genus.

Amphiproræ are tolerably plentiful, they much resemble the frustules of Donkinia in their front aspects, as may be seen by reference to the diagrams, but their side views closely resemble the common Naviculæ, the exception being that in the Naviculæ the median lines are in or near the middle of the frustules, while in the Amphiproræ the median lines form double curves in close contiguity to one of the sides.

The whole of the genera just referred to are marked by striæ of greater or lesser fineness; some are so coarsely striated that the lines are visible by means of a lens of low power, say $\frac{2}{3}$rds of an inch, and others are so delicately and closely striated that the striæ are only resolvable by the highest microscopical power and the most perfect illumination.

Many of the Pleurosigmata, such for example as marinum, nubecula, and obtusum, are coarse; lanceolatum and fasciola are fine; prolongatum and arcuatum are, with a Ross' $\frac{1}{8}$th, achromatic condenser, and central or other stop, difficult of resolution, and spectrosum, a new diatom I am unable to resolve.

The striæ of the Toxonidea, are all double oblique; on the Pleurosigmata they are double oblique, transverse, and longitudinal; on the Donkiniæ they are the same; on *Amphiprora alata* the striæ are transverse, but on *Amphiprora duplex* they are absent or invisible to the power at my command.

The lines on local marine diatomaceæ vary from 10,000 to 80,000 in an inch, and they form admirable tests for the higher powers of microscopes. The celebrated test object of a few years ago, *Pleurosigma angulatum*, is now exceeded by the more delicate striæ of *Pleurosigma lanceolatum*, *Toxonidea insignis*, *Donkinia carinatum*, and *Pleurosigma arcuatum*.

A New Microscopic Growing Stage.

By John Barker, M.D. University of Dublin.

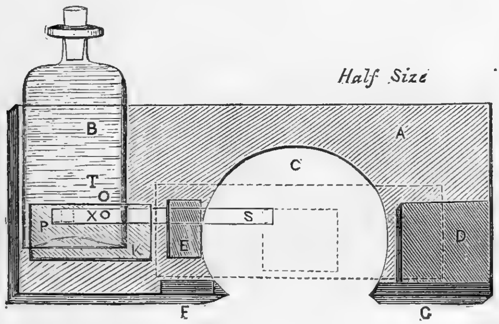
(Exhibited at the Dublin Microscopical Club.)

The advantages of some contrivances for facilitating the examination of objects from time without disturbance, and which could be kept as nearly as possible under the same conditions under which they were first observed, has at all times been a desideratum in microscopic science; and the pages of

the 'Microscopical Journal' have been usefully occupied in making known several valuable aids for this purpose; and as the growing stage lately brought under the notice of the Dublin Microscopical Club appears to present some advantages over growing slides at present in use, I have been induced to furnish a more ample description of it with an illustrative diagram. To my view, a growing stage or slide should possess the following qualities:—1. It should be efficient, and not likely to go out of order, neither flooding the object and overflowing the stage, or drying up and allowing the air to get under the cover; (2) it should be easily cleaned; (3) it should work well for at least a week, and even then should be capable of being suppled with fresh water without disturbing the object; (4) it should enable the investigator when, in ordinary microscopic examination with a common slide and cover, he may have found something which he may wish to preserve moist, and observe at on a future occasion to do so with facility; (5) it should allow of the object being examined at any time without displacement; (6) it should permit the whole of the covering glass to be examined, and it should not be in the way of any other piece of apparatus; and lastly, it should not be costly in price. Now, all these objects seem to me to be secured in the growing stage under consideration. The appliance would appear to be peculiarly valuable to those who would wish to watch the varying changes in microscopic algæ, rhizopods, infusoria, rotifera, or anything requiring to be kept moist while under investigation. The microscopist, in his usual investigations with an ordinary slide three inches by one inch, and with a common covering glass, frequently sees objects which he would wish to keep under notice for several hours, perhaps days or weeks, and this he will be enabled to accomplish by merely placing the slide on this stage, and at any time transferring it again to the stage of the microscope, or by putting the growing stage, with slide upon it, onthe stage of the microscope, the whole of the covering glass can be brought under inspection, so that no object which had been under the covering glass can escape observation. I have several rhizopods under notice at present for upwards of a week; and I have kept rotifera healthy for days in this appliance. The construction of this stage is so simple as to admit of any one expert in cutting glass to make it in a few hours; and I have drawn a diagram, to scale which will facilitate its construction.

A is a piece of stout glass from which is cut a large segment of a circle, C; B is a small flat bottle about two inches long, one inch wide, and about a quarter of an inch

thick, or less if it can be procured; this bottle is fastened on the plate A with cement or marine glue; K is an oblong piece of glass a little longer than an inch, and about three quarters of an inch wide, and of the thickness of ordinary slides; this is cemented on the front of the bottle, and through it and the bottle is drilled a small hole, and another hole, T, is also drilled a little above the latter into the face of the bottle; D and E are two blocks of glass of the same thickness as the bottle, and which are also cemented to A; F and G are the ordinary ledges for supporting the slide which is represented with covering glass in dotted lines as resting on blocks D and E, and close up to K; P S is a thin piece of



talc fastened with cement at P, or even loose, and covering the hole X, and continuing on over the slide so as to rest on a small portion of the cover. By raising up the end, S, the slide can easily be placed *in situ*, and then allowing the talc to fall gently on the covering glass, it will convey the water from the hole in the bottle to the object under the cover, the upper hole supplying the air to the bottle, which can be filled when exhausted by putting the finger on the apertures, taking out the cork, and pouring in fresh water. The stage can be put on the stage of the microscope with the slide on it, or the slide can be slipped out on raising the talc with a needle. The growing stage is to be kept on a small wooden stand like a reading stand at about an angle of 50°.

On some of the Microscopic Effects *of the* Electric Spark. By R. T. Lewis.

(Read at the Quekett Microscopical Club, September 28th, 1866.)

In the early part of last December I called upon a friend, who showed me an improved form of induction-coil, which, from the peculiarity of its construction, was capable of giving much more brilliant results than instruments of the same size made in the ordinary way. In the course of a number of experiments with this coil, my friend held a card in the path of the sparks between the terminals; and although these were several inches apart at the time, every spark passed through the card, making the well-known raised burr round each perforation. This done, he tossed the card to me, saying in joke, "There, I'll make you a present of that as a memento." On reaching home, my microscope being at hand, I placed the card upon the stage to see what might be the microscopic peculiarities, if any, of the burrs surrounding the perforations. My attention was, however, at once arrested by observing that the shape of the holes themselves was not circular, as might have been expected, but clearly and sharply *pentagonal.** Many holes were filled up by portions of disrupted fibre which had fallen into them; others had been made in so oblique a direction that their actual shape could not be very well made out; but the remainder—some thirty in number—were, as I have stated, *five-sided;* and the question at once arose, to what cause is this peculiarity of shape due?

A number of curious facts, which were detailed some years ago in 'Recreative Science,'† and which seemed to bear upon the subject, led me at first to suppose that the shape of the holes might possibly be due to the sparks having taken a definite form from the microscopic shape of the points of the terminals from which they had been discharged. I therefore perforated some pieces of paper and card by sparks passed between the points of two sewing-needles, also between the ends of pieces of copper-wire simply cut from a length and without preparation; but in each instance all those holes which were clear, and through which the sparks had passed in a direction at right-angles with the surface of the paper, were, as before, *five-sided;* and I afterwards found that the effect was the same when wires of different metals were used,

* From an inspection of Mr. Lewis's drawings we feel bound to say that the perforations appear to us more frequently *hex*agonal than pentagonal.—Ed.

† Vol. i, p. 188.

either pointed or blunt, or even when the sparks were passed between two smooth brass knobs.

With a view to ascertain whether the texture of the material had any influence in determining the shape of the holes, I next procured specimens of various kinds of paper and card, and perforated them by sparks from $\frac{1}{4}$ inch to 5 inches in length, still further varying the experiments by using different induction-coils, and by obtaining the inducing-currents from the action of batteries of different kinds, in all of which cases the results tended strongly to confirm the observations previously made. When sparks of great intensity but small quantity were employed, the perforations were generally well defined at their edges, and were made without any indication of a raised burr being formed on either side of the paper; and when many sparks were permitted to pass through the same hole, it was gradually enlarged by their action, but preserved its original shape for some time after the heat had begun to scorch its margin. In *common blue-laid or wove post* and in *varnished cardboard* the continued action of the sparks calcined the fibre, and a quantity of ash remained in the holes, but the pentagonal shape was well defined in almost every instance. In thick, white, unglazed paper somewhat less ash was left; but in highly finished, thick, cream-laid note-paper no trace of it could be found—the diameter of the holes by sparks from 2 inches to 5 inches in length being from $\frac{1}{90}$th of an inch to $\frac{1}{300}$th of an inch. Sparks from $\frac{1}{8}$th of an inch to 1 inch through cream-laid note-paper gave equally clear results, especially in those instances where the fewest number of sparks had passed through, the diameter of the holes being from $\frac{1}{50}$th of an inch to $\frac{1}{1000}$th of an inch. In the case of thick card some difficulty was experienced, owing to the very oblique and sometimes zigzag course which sparks frequently took in passing through; but the pentagonal form was even more distinct than in paper, and neither ash nor burr were present in any instance, the diameter of the holes varying from $\frac{1}{80}$th of an inch to $\frac{1}{200}$th of an inch.

By way of accumulating the electricity, and obtaining sparks of much greater "quantity," a small Leyden jar was then included in the circuit, and the terminal wires respectively connected with its inner and outer coatings. The effect of these condensed sparks upon card was very violent, a large raised burr being formed on both sides round every hole, whilst the disrupted fibre was heaped up in such a way as to obscure their outline; it was therefore necessary to make thin transverse sections of the card, in order to ascertain the true shape of the perforations. The continued action of these

condensed-discharge sparks rapidly enlarged, and burnt out the edges of the holes, altogether destroying their original forms.

Observing that not infrequently sparks deviated from their direct course, in order to pass through adjacent portions of the paper which offered them less resistance, I tried some French insulating paper, but the heat of the sparks here melted the wax or composition with which the paper was saturated, so that it not only surrounded the holes in a thickened condition, but there was evidence, in most instances, of its having overflowed them, and thus materially interfering with the shape of their actual margins. The perforation of thin microscopic glass was not more successful, for in every case the spark, on striking the surface, coursed along it for a considerable distance before passing through, splintering or fusing it in such a way as to render it impossible to decide what was the real shape of the perforation.

A Leyden jar was next charged in the ordinary way by means of a common cylinder machine, and the sparks from it were caused to pass through a card which was placed between the knob of the jar and that of the discharger. The disruptive effect of these was very violent, large burrs being raised over the holes, which entirely prevented their shape from being seen; thin sections were, however, made with a sharp microscopic dissecting-knife, and here again the five-sided character of every hole was clearly made out, notwithstanding the quantity of loose fibre which was strewed across them.

Of the results of the foregoing experiments I have made careful drawings, by means of the camera-lucida (Pl. II); the micrometer scale will be found marked on each figure. In several instances the outlines of the fibre of the paper are shown, from which, I think, it will be evident that the peculiarity of shape is not due to the texture of the material.

The figures show the effect of induction-sparks of various lengths; some that of condensed-discharge induction-sparks; while Fig. 6 shows that of discharge-sparks from a Leyden jar charged with frictional electricity.

It must be borne in mind that in every experiment except that with the Leyden jar the paper or card was held by the hand, and was moved about between the terminals during the passage of a very rapid succession of sparks; it is therefore most probable that several sparks passed through the greater number of holes, and, in consequence of the movement of the paper, the majority of these must have passed through in a more or less oblique direction.

These and other considerations rendered it very desirable that some contrivance should be adopted by which this unsteadiness might be obviated, and the observer enabled at the same time to see the precise effect of every individual spark. This was accomplished by performing the experiments under the microscope itself, the mode of doing so being as follows:—Two plates of glass were cut so as to be about half an inch longer than the stage, and a small hole, about one eighth of an inch in diameter, was drilled in the centre of one of them. A copper wire, having one end finely pointed and turned up at right angles, was then placed between the glass plates in such a position that the turned end occupied the centre of the hole, but did not project above the surface; the plates were then cemented together with marine glue, thus forming at the same time an insulating stage and a holder for one of the terminal wires. The end of a glass-dipping tube, mounted in the same way as a pair of stage forceps, served to hold and insulate the other wire, the finely pointed end of which was bent so as to enable it to be brought into the centre of the field in a straight line with the end of the wire in the glass stage, whilst, by the universal motion of its mounting, the length of the sparks could be easily regulated. A simple battery after the French pattern, a small induction-coil capable of giving three quarter inch sparks if required, and a rheotrope by which the current could be instantly broken or reversed at will, completed the apparatus, and rendered it possible to conduct the experiments with perfect ease and steadiness. The position of the points having been carefully adjusted, the paper to be operated upon was placed upon the glass stage, illuminated both by transmitted and reflected light, and properly focussed, and on making the circuit the effect of every spark could be seen in a perfect and most beautiful manner.

It is perhaps unnecessary to state that great care is required in thus dealing with so energetic an agent as electricity, which is ever on the alert for opportunities of completing its circuit by the shortest course through the best conductors, and which makes no excuses for inadvertence. If the wires are perfectly insulated from the stage, there need be no fear of sparks passing from the eye-pieces to the operator's face; but accidents are very liable to happen during manipulation, from the hands coming in contact with portions of the apparatus, whilst the eyes are attentively engaged at the binocular and the attention is absorbed by the increasingly interesting character of the observations.

In repeating the foregoing experiments upon the stage of

the microscope in the manner described, the observations as to the five-sided shape of the spark perforations were not only confirmed, but an explanation was given of the causes of some variations from that shape which had been previously noticed. Chief amongst these, it had been observed that certain holes, whilst sharply angular on one side, were rounded on the other. Now, in practice it frequently occurred that a spark, instead of passing through that portion of the paper lying immediately between the terminal points, would perforate some adjacent part where the texture probably offered it a less degree of resistance, so that its path would be represented by the two sides of a triangle, the angular point of which being the place of perforation. If, then, the current was continued, the succeeding sparks followed each other so rapidly as to present the appearance of a quivering thread of fire being drawn obliquely through the hole, with the result that that side of it only which was nearest to the direct line between the points was abraded, and had its angles rounded by what may be termed the friction of the stream in endeavouring to straighten and thus shorten its course. The samc effect was produced when the paper was moved during the passage of the sparks, which would continue to pass through a hole until its distance from the perpendicular line caused the resistance of the atmosphere to exceed that of the paper, when a fresh perforation was made. Often, too, when a number of holes were in the field of view at the same time, the stream of sparks would fly from one to the other without apparent cause, in all of which instances the original symmetry of form would be more or less destroyed according to the obliquity of the courses taken; and it will also have been anticipated that great irregularities of surface, or the interposition of fibres too tough for the spark to break directly through, would contribute to the occasional production of exceptional shapes.

During the progress of these experiments it was suggested to me that some further test should be applied in order that, if possible, more direct proof might be afforded that the pentagonal outline of the holes was due to a corresponding shape of the spark, and biniodide of mercury was named as being well suited to the purpose. This beautiful scarlet powder is of so volatile a nature that a moderate degree of heat is sufficient to partially decompose it, upon which its brilliant colour is instantly changed to a dull greenish-yellow. A small quantity of this powder was accordingly rubbed down upon paper, and on passing this between the terminals whilst the coil was in action the perforation of the paper

and discoloration of the surrounding powder took place simultaneously. It was expected that if the spark itself were actually five-sided, the heat radiated from it would cause the discoloured space to be of the same shape, and in some few instances such was the case, but in the majority the conditions were such that no great reliance could be placed upon the result as a test. The union between the powder and the paper was merely mechanical, so that its separate particles were visible when magnified, and were often detached and made to dance about on the surface by the vibrations caused by the sparks, in addition to which the smoothest paper procurable was microscopically rough, and its surface was not improved in this respect by the amount of rubbing required to work the powder into it. Further attemps were then made to obtain some impress of the heat of the spark by using paper which had been saturated with diluted sulphuric acid and dried. Exposure to heat rapidly carbonizes this, and on placing it in the path of the sparks the perforations were seen to be bordered with black almost as soon as made. The action of the acid had also so far rotted the paper that it offered comparatively little resistance to the passage of the sparks, and the pentagonal shape of the holes was consequently much more uniform and sharp than in any previous experiments. The continuance of the current increased the size of the holes much more rapidly than had been the case in former instances; but although the outline of the scorched margins for the most part corresponded with that of the holes, the varying thickness of the paper obviously prevented it from always extending itself equally in every direction. Whilst operating upon this paper it was noticed that at the instant of perforation, and for some few seconds afterwards, the edges of every hole glowed with great brilliancy; this was owing to the heat of the sparks having first carbonized the paper, and next raised it to a state of incandescence, until, being entirely consumed, it passed away in a tiny shower of microscopic sparks; in fact, for the time, a minature electric light had been produced.

Amongst other substances made use of, the dried leaves of plants and trees were tried with some success, especially those of the laurel and plane, whose cuticle presented a comparatively smooth surface. Here also scorched borders surrounded each perforation, their outlines in many instances closely corresponding with each other in shape. The faded leaf of the plane tree was rapidly consumed by the continued action of the sparks, a strong smell being produced, and two bright red bands being added to the spectrum by its incandescent

particles. Thin laminæ of mica resisted attempts to perforate them by the means at command, the electricity simply spreading itself over the surface in a lambent blue flame. Parchment for the most part allowed sparks to pass through it without any marked disruptive effects, and where holes were made the heat caused their edges to shrivel or contract in a sufficient degree to materially alter their original outlines. A similar effect was also observed in the case of the membrane which lines the interior of the egg-shell; and when polished plates of steel were placed between the terminals their surfaces were oxidized by the sparks, but the spots thus produced were neither of distinct nor uniform shape.

As to the results of these experiments, so far as they have been conducted, they would appear to lead to the following conclusions:—That the true shape of the perforations made by the electric spark is pentagonal; that this shape is constant, without regard to the sources from which the electricity is obtained; that it is not due to the shape of the extremities of the terminals or other points from which the sparks are discharged, nor to the texture of the substance perforated; and from these conclusions it might be reasonably inferred that it is due to the peculiar shape of the spark itself, although it would perhaps be considered premature at present, and in the absence of further evidence, to insist upon this as a thing proved.*

* Supposing the perforations to be six-sided, as they appear to us, and not five-sided, as Mr. Lewis thinks they are, an explanation is not so difficult. The shape of the spark itself is, in all probability, that of a more or less regular cylinder, whose section is a circle. The resistance offered to the passage of the spark by the perforated paper or card, acts at the point of passage on its cylindrical form in a manner analogous to that in which equal pressure from all sides acts on a solid cylinder, rendering it hexagonal; though the spark must not be regarded as anything but a condition of the atmosphere. The cases of the basaltic pillars of the Giant's Causeway and of agglomerated soap-bubbles are well-known instances of this law of pressure.—Ed.

TRANSLATION.

On the Structure *and* Physiology *of the* Retina. By Professor Max Schultze.

The paper of which we here give an abstract has just appeared in the last number of the author's 'Archiv f. Mikroskop. Anatomie,' in which it occupies more than 100 pages, and is illustrated with eight quarto plates. It is undoubtedly one of the most interesting and important contributions to our knowledge of the very difficult structure of which it treats that has ever appeared, and it may be taken as giving an almost exhaustive account of all that is known on the subject, together with much, more especially in the physiological part of the subject, altogether new; and we deeply regret that our space prevents our giving a more lengthy notice of its contents, or, what would have been very desirable, a complete translation of it.

In his general account of the structure of the retina we do not perceive that Professor Schultze differs very materially from most later writers on the subject. What he says respecting it may, however, be very briefly stated as follows:

The retina in man is composed of a fibrous or trabecular framework, composed of connective tissue, and which serves as a support to the nervous or sentient elements. The fibrous framework consists of an *outer* and an *inner membrana limitans*, connected together by a network of fibres, the principal of which, passing from one limiting membrane to the other, constitute the "radial fibres of Müller." These are connected by irregular lateral fibres, so that the whole constitutes, speaking generally, a sort of wide trabecular network; but at two special levels in the retina the fibrous tissue forms a very close, almost membraniform plexus, the

outer and thinner of which corresponds with the so-termed "intergranular layer," and the inner in the same manner corresponds with the "molecular layer" or outer part of the "layer of grey substance." The *membrana limitans externa* in the fully developed organ does not constitute a continuous expansion, but is perforated with numerous closely placed openings, like the shelf of a bottle-rack. The *membrana limitans interna,* properly speaking, is also not a continuous membrane, but a reticulated tissue composed of the expanded ends of the radial trabeculæ or "fibres of Müller." This fibrous framework supports the nervous part of the retina, which may be subdivided into six, or more properly, perhaps, seven distinct layers. These layers, proceeding from without inwards, are—1. The bacillary layer, composed of "rods" and "cones," placed vertically on the periphery, and each lodged by its inner extremity in one of the openings in the outer limitary membrane. 2. The "outer granule-layer," composed for the most part of granular nucleated cells, connected with either the "rods" or "cones," and traversed by the filaments proceeding from those bodies. 3. The "intergranular layer," which is constituted, as before remarked, in part of a fine, fibrous, trabecular network, intermixed with which is a still finer plexus of very delicate nerve-fibres, for the most part, as it would seem, continuous with the terminal fibrillæ of the cone-filaments, and perhaps also in part with the terminations of the rod-filaments, although this has not been as yet clearly made out. 4. The inner granule-layer, containing for the most part bipolar ganglion-cells and abundance of fine nerve-filaments. 5. The "molecular layer," which is of considerable thickness, and, like the "intergranular layer," apparently composed of an intricate interlacement of very delicate nerve-filaments and the fine trabecular network before mentioned. 6. The "ganglionic layer," constituted chiefly of large multipolar nerve-cells, each of which on its inner aspect appears to be connected with a fibrilla of the optic nerve, and on its outer to give off several processes which break up into the delicate fibrils contained in the molecular layer. 7. The layer of "optic nerve-fibres," which in most animals appear to have no sheath, but to represent axial filaments.

The author's researches have been directed more especially to the distinction between the "rods" and "cones." But his attention has been turned, not so much to their morphological characters, with respect to which little now remains to be said, as to their relations to the other retinal elements, so that he might be able, if possible, to obtain some insight into their physiological differences. That such differences must

exist cannot be doubted by any one who regards the unequal distribution of the two elements in different parts of the human retina, and remembers that in the most sensitive part of it, as is well known, "cones" only exist, whilst in every other part the "rods" far exceed the "cones" in number. But these conditions have hitherto remained unexplained, as has also the remarkable fact that in the retina of many animals the "rods" alone are found, and in others only "cones." In the prosecution of his object, therefore, M. Schultze has found it necessary to examine, not only the human retina in its various regions, and particularly in the *macula lutea* and *fovea centralis*, but also to investigate all the varieties of structure exhibited in other animals. And in order to leave no means untried for arriving at a satisfactory elucidation of the subject, he has further closely studied the development of the retina, and particularly that of the bacillary layer.

The first section of the paper is devoted to the consideration mainly of the bacillary layer in the human subject, whose general structure is described much in the usual terms. The observations were made upon the recent human retina prepared with dilute osmic acid, and the beautiful illustrative figures are stated to have been taken from nature. They are excellently done, and doubtless accurately represent the structure as thus prepared. Retinas hardened by immersion in solutions of osmic acid containing $\frac{1}{2}$—$\frac{1}{10}$ per cent. are readily split up by means of needles into their laminæ parallel with the radial fibres ; and these products of natural fissure are clearly, the author thinks, preferable to thin sections. The principal points to which we shall refer, contained in this section, are :—(1) The fine longitudinal striation observable in the "cones" and "cone-filaments." (2) That the space between the "cone-filaments," as they cross the outer granule-layer, is entirely occupied by small, closely crowded cells, all of which are connected by finer or coarser filaments with the "rods." These cells may be regarded, with H. Müller, as bipolar ganglion-cells. (3) The distinctive characteristics of "cone-filaments," which are much thicker than those of the "rods," are then detailed, and the differences between them and the fibrous radial trabeculæ pointed out.

The relations of the "rods" and "cones," and the disposition of their filaments in the neighbourhood of and in the macula lutea, are next described, and particular pains are taken to render the structure of the retina in the *macula* and *fovea centralis* clear and intelligible, and, as it appears to us, with complete success.

The structure of the retina in mammals and other vertebrates is then compared with that of the human eye regarded as a typical form.

Apes, as is well known, possess a *macula lutea*, and in other respects their retina seems to agree very closely with that of man, even in the comparatively great thickness of the "cone-fibres."

Among the other mammalia a very remarkable and, as it would seem, hitherto unnoticed diversity, with respect to the distribution of "rods" and "cones," exists. Whilst most of our larger domestic animals, especially the sheep, ox, pig, horse, and dog, present an arrangement of those elements resembling that which is observed in the human subject and in apes, except, of course, in the absence of the *macula lutea*, the cones, according to the author's observations, are entirely wanting in bats, the hedgehog, mole, mouse, and guinea-pig. A sort of intermediate condition is met with in the cat, rabbit, and rat, in which animals are found either very slender true "cones," as in the cat, or merely indications of them, as in the rabbit. But in any case the "rods" preponderate so much that the "cones" among them may readily be overlooked. According to Ritter, the "cones" are also wanting in *Balæna mysticetus*.

In the rat the "rods" are the longest and slenderest yet met with by the author. In the other vertebrate classes the proportion of "rods" and "cones" to each other approaches nearest to that observed in the mammalian retina in the osseous fishes. In the ray and shark "rods" only exist. In *Petromyzon* elements of one kind only occur in the bacillary layer; but whether these be "cones" or "rods" is undetermined, nor is it determined whether, as supposed by some, both elements may not really be present. The osseous fishes afford excellent materials for the study of the "cone"-fibres; which at one time M. Schultze regarded as belonging to the connective-tissue framework of the retina, and to represent in the outer granule-layer the "radial fibres of Müller" in the other layers of the retina; but of their nervous nature, as of the corresponding fibres in the human retina, he is now thoroughly convinced.

The structure of the retina in birds, reptiles, and amphibia, differs in a very peculiar manner from that of mammals and fish. In the bird's retina the proportion of "cones" to "rods" is in the reverse proportion to that in the mammalia. In other words, the retina of the bird, as regards the distribution of "rods" and "cones," approaches that which is observed in the human *macula lutea*, inasmuch as the "cones" pre-

ponderate greatly over the "rods." The same disposition is found in the retina of reptiles. In the turtle the arrangement is precisely the same as in birds, whilst in the lizards the "rods" are wholly wanting, as they would appear to be also in snakes. An exception, however, to this rule, as regards birds, is afforded in the owl, in several species of which (*S. aluco, noctua,* and *flammea*) the preponderance in number would seem to be in favour of the "rods;" and from this circumstance, as well as owing to the enormous length of the "rods" in proportion to the "cones," the mosaic aspect of the outer surface of the retina in these birds bears a striking resemblance to that of the bat. And owing to the same condition also, the owl's retina is almost everywhere destitute of the colours so characteristic of the membrane in other birds. And another remarkable circumstance with respect to the retina in owls is the total absence in it of red pigment-globules; and even the few yellow cones become paler and paler towards the *ora serrata,* until at length they are entirely colourless. These facts would seem to point out that, as the retina of nocturnal mammalia is distinguished by the total absence of "cones," so in the case of the owl the comparative paucity of the same elements, together with the pale colour of the few pigment-globules, may also be connected with its nocturnal habits and avoidance of light. It would, therefore, M. Schultze remarks, be very interesting to examine the retina of other nocturnal birds, as of the Caprimulgidæ, &c.

Another and most characteristic peculiarity of the retina of birds, some reptiles and amphibia, but more especially of the first, is the presence in most of the "cones" of a spherical globule of red or yellow colour, but chiefly yellow, and which is situated at the junction of the inner and outer segments, that is to say, at the internal end of the latter, whose whole diameter is occupied by it, and consequently all the light reaching the outer segment of the cone must pass through this coloured medium. The author's observations would seem to show that the yellow colour predominates in the more sensitive parts of the retina. At least, this presumption arises from the circumstance that in such birds as the pigeon, crow, and hawk (although swift-flying birds), which present a *fovea centralis* (in the hawk two), the elements in that part all contain yellow spherules.

The retina of reptiles closely resembles that of birds. In lizards, according to Leydig, two kinds of elements are distinguishable—one of a slender form, and furnished with a deep yellow spherule; and others of a broader conical shape,

whose apex is coloured with a diffuse yellow pigment. Both these elements, however, it would seem, according to Schultze, should be regarded as "cones." According to H. Müller, the retina of the chameleon contains only elements of one kind, which must also be regarded as cones. In the cones of *Anguis fragilis,* which have been subjected to osmic acid, and, apparently, according to Müller, in the chameleon, a peculiar differentiation of the contents of the inner segment of the cones is observable, in the appearance of a conical, strongly refractive body, the base of which is directed outwards, whilst the pointed proximal extremity looks towards the *membrana limitans externa,* though it does not actually reach it.* These bodies were supposed by Müller to represent cell-nuclei, but M. Schultze suggests that they are refracting lenses.

Throughout the amphibia a great uniformity exists in the retinal elements. Amongst numerous colossal "rods" are lodged a few very minute "cones," each of which contains a minute-coloured or colourless spherule.

M. Schultze confirms Henle's discovery of the presence of one or more *transverse lines* in the outer granules, or rather on those of the outer granules which are connected with the "rods," as they are not found on those belonging to the "cones." These markings appear to be absent in all other vertebrates.

A very full account of the structure and relations of the black pigmentary layer is given, and reasons shown for its being regarded as an element, not of the choroid, but of the retina itself. It consists essentially of a layer of cells containing black pigment, and which send down fine filamentary processes, like the pile of velvet, to fill up the spaces between the outer segments of the "rods" and "cones."

The paper then proceeds to give an account of the arrangement, &c., of the "cones," which alone constitute the percipient stratum in the *macula lutea.* It is shown that as the border of this spot is approached the number of "rods," in proportion to that of the "cones," gradually and regularly diminishes, until at last the former cease altogether, whilst at the same time the "cones" themselves become longer and slenderer up to the centre of the *macula;* the direction, also, of the cone-fibres becoming more and more oblique as they radiate, as it were, from the centre of the *macula.* As is now well known, the layer of "cones" is continuous over the so-

* This is probably the "albuminous substance which, in chromic-acid preparations, retires as an opaque granular mass towards the outer end of the body of the cones," noticed by Mr. Hulke ('Proc. Roy. Soc.,' xiii, p. 109).

termed *fovea centralis*. Some very interesting observations are given on the subject of the relation of the diameter of the "rods" and "cones" to the acuteness of vision, &c.; and the probability is shown that at the point of junction of the outer and inner segments of the "rods" and "cones," which differ so much in their refractive properties, and between which, as pointed out by Krause, even in the perfectly fresh state so sharp a line of demarcation exists, the light passing through the retina to the "rods" suffers reflexion upon the end of the inner segment, or upon true percipient nervous point, as it may be termed.

The third section treats of the development of the retina, and especially of the "rods" and "cones," and it contains many extremely interesting original observations. The author's study seems to have been principally directed to the development of the eye in the chick. He shows that the pigment-layer of the retina, or the inner layer of the choroid, as some deem it, is formed in the outer coat of the primitive eye-bulb-sac, and that the outer and at first perfectly even surface of the inner coat of the bulb is in close contact with the outer. The surface of the inner fold of the primitive bulb-sac is formed by, or rather represents, the future *membrana limitans externa*. The first indication of the formation of the "rods" and "cones" is visible on the previously perfectly even surface of this membrane in the appearance, about the tenth day of incubation, upon it of minute hemispherical elevations, which are, in fact, the rudiments of those elements into which the elevations gradually grow.

In mammalia the necessary continuous observation is not so readily made, but sufficient has been ascertained to show that the development of the retina in them proceeds in the same way as in the fowl. In fresh embryo calves, in specimens from fifteen to twenty-five centimeters in length, the *membrana limitans externa* was in close contact with the pigment-layer, and no trace of either "rods" or "cones" was visible. In specimens fifteen to twenty centimeters long, hardened by immersion in "Müller's fluid," or in a weak solution of nitric acid, although the nerve-fibre-layer of the retina was distinct enough, none of the other layers were as yet differentiated from the general substance composed of spindle-shaped cells having elongated nuclei and processes passing to the outer and inner *membrana limitans*.

In embryo sheep, at the time of birth or very nearly so, "rods" and "cones" were present, but not at an earlier period. They were, however, shorter, and, above all, much more delicate, than in the full-grown animal.

It would appear that in the sheep and other mammals the "rods" are not developed until the differentiation of the other parts of the retina has advanced some way, nor before the end of embryonal life; but in some instances, as in the rabbit and cat, this is seen in a far more striking manner. Neither of these animals at birth present any trace of "rods" and "cones." The blindness, therefore, of the new-born rabbit and kitten does not depend solely upon the closure of the lids, but is also associated with an undeveloped state of the retina itself. The "rods" and "cones" do not appear to be fully developed before the thirteenth day, when they are in the same condition as in the calf or lamb at birth.

The development of the "rods" and "cones" in man appears to follow the same course as in the ruminants above named.

The fourth section relates to the differences between the "rods" and "cones," with respect more especially to their functions. And in it is given a recapitulation of the principal anatomical facts upon which the physiological conclusions or suppositions are based, in the following words:

"With the enlargement of our knowledge of the structure and disposition of the two elements composing the percipient layer of the retina—the 'rods' and 'cones'—arises the question whether we are thus in a condition to attempt the problem of the hitherto unknown physiological distinction between them. We hear that, at any rate, the direction in which the solution of this question is to be sought may now be indicated with some degree of certainty, and I will endeavour briefly to state my views, as follows:

"The anatomical facts upon which we have to rely, shortly recapitulated, are these:

"1. The difference in size and form. This is manifested more particularly in the so-termed inner segment, which in the 'rods' is always sharply defined from the outer segment, but which may also be distinguished as a separate element also in the 'cones.' The inner segments in both the 'rods' and 'cones,' in the perfectly fresh condition, consist of an apparently almost structureless substance, but which very rapidly, after death and in all preservative media, coagulates into a more or less distinctly granular matter. This substance, to judge from micro-chemical reactions, most nearly resembles albuminous matter, as, for instance, the protoplasm of young cells. An essential distinction between the substance of the inner segment of the 'rods' and of the 'cones' is manifest in the circumstance that solutions of osmic acid of a certain strength produce in that of the cones a very distinct parallel striation, which, under similar conditions, I am unable to perceive in the inner segments of the 'rods.' No universal distinction exists in the absolute diameter of the inner segments, as, for instance, in the human retina; for although the cones throughout by far the greater part of the retina are fully twice as thick as the rods, their inner segments in the *fovea centralis* are quite as slender as those of the 'rods.' The outer segments or shafts consist of a more highly refracting substance, which after death coagulates in

a different manner from that composing the bodies. This substance does not become granular, like protoplasm, but either hardens into a homogeneous mass or shrinks and curls up in a peculiar manner, at the same time cracking, generally transversely, but sometimes also longitudinally. That an external tunic and contents—a cortex and central filament—can be distinguished in them I hold to be highly improbable. The outer segments of the 'rods' are cylindrical, though a very slight attenuation towards the choroid may occur (frog); on the other hand, the outer segments of the 'cones' are of a decidedly conical form, the apex pointing outwards, and usually terminating below the summits of the rods.

"2. A very remarkable difference between the 'rods' and 'cones' is presented in the filaments proceeding from them to the external granule-layer. The filaments belonging to the 'cones' are of considerable thickness, which sometimes is as much as 2—5 micro-millimeters; they exhibit here and there a delicate longitudinal striation, as if they were composed of parallel fibrils; and they always break up on the upper surface of the intergranular layer into an indeterminate number of extremely delicate fibrils, which are lost in that layer.* The fibres proceeding from the rods, on the contrary, have a scarcely measurable thickness, and they can only be traced to the surface of the intergranular layer, where they apparently terminate in a minute enlargement whose nature is at present obscure. Each filament, whether belonging to a 'cone' or 'rod,' is in some part of its course connected with a cell—an outer granule—so that the outer granules may be divided into 'rod' and 'cone-granules,' of which the latter, at any rate in the mammalia, are the larger. Both kinds of filaments present all the characters of nerve-fibres, and much resemble those of the optic nerve-layer, and, on the other hand, they are manifestly distinguishable from those of the trabecular framework.

"3. At the yellow spot of the human and simian retina 'cones' only exist. Close to its periphery, however, 'rods' become interposed between them, and at a few millimeters from the middle of the spot they are present in the number of two to three between each two 'cones,' a proportion which is continued uninterruptedly up to the *ora serrata*. In proportion as they become crowded together at the *macula lutea*, their fibres, as well as those of the 'rods' interspersed among them, assume an oblique direction, radiating, as it were,

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* In a valuable communication to the Royal Society, read in June, 1866, on the "Chameleon's Retina," Mr. Hulke states "that from the inner ends of the cones fine fibres proceed obliquely from the outer to the inner surface of the retina in a radial direction from the centre of the *fovea* to the periphery of the retina." These fibres connect the cones with the cells of the outer granule-layer; they next form a thick plexus at the inner surface of this layer, which he terms the "cone-fibre-plexus;" then traverse the inner granule-layer, in which they connect themselves with round and roundly oval cells, and are continued through the medium of the ganglion-cell-like cells of this layer into the granular (molecular layer, Schultze), where they join the processes directed outwards from the cells of the ganglionic layer. "Thus," he says, "they constitute an anatomical path between the cones and optic nerve-fibres."

This, if confirmed by future observation, is a most important fact, and one of great import with relation to the apparently more direct and immediate communication between the "cones" and optic nerve-fibres than would seem to obtain with respect to the "rods."

from the centre of the *macula* in a meridional and forward direction, in order, after a longer or shorter course, to reach the outer granular layer.

"4. In most mammalia the relative number of 'rods' and 'cones' is exactly the same as in man, with the exception, of course, of the *macula lutea*. But in many the cones are altogether absent. This is the case in animals which prefer darkness to light, such as the bat, hedgehog, mole, mouse, and probably a great many others. In the rabbit, which, as is well known, in the wild state inhabits subterranean passages, there are, it is true, indications of cones, though these appear to be in quite a rudimentary state.* The cat has distinct though slender cones, which are placed wide apart, so that room is left between them for twice or thrice the number of 'rods' than in the human retina.

"5. Birds have many more 'cones' than 'rods,' the former, in fact, standing to the latter in the inverse proportion to that in which they occur in the human subject. In both the *foveæ centrales* of the falcon 'cones' only exist [as well as in the single *fovea centralis* in some other birds]. But the owls almost resemble the bat, their retina containing but very few cones and an enormous proportionate number of rods. In their retina scattered 'cones' only occur at wide intervals, and these are so overcrowded by the very long outer segments of the 'rods' as to be seen with great difficulty.

"6. The 'cones' in birds are distinguished by a very remarkable character. The greater number of them are furnished, at the end of the inner segment and immediately in front of the point of attachment of the outer segment, with a highly refractive globule, for the most part of a deep yellow or red colour, anything analogous to which, so far as is at present known, is wanting in all mammals. The yellow globules are more numerous than the red. The coloured globules have a diameter precisely corresponding with that of the base of the outer segment, so that no light can reach that part without passing through the globule. The few 'cones' which have no coloured globule contain at the corresponding point a strongly refractive colourless body, apparently of the same kind. The few 'cones' existing in the owl's retina are furnished with pale yellow or colourless globules. Red globules are entirely wanting in the retina of those birds (*Strix aluco, noctua,* and *flammea*).

"7. Among reptiles, in some, as the turtle, the retina appears to present the same structure as that of birds. Lizards and snakes have only cones, and in some instances these contain pigment-globules in the same situation as in birds (*Lacerta,* sp. *Anguis fragilis*), whilst others are without these coloured elements (chameleon and snakes).

"8. The amphibia (frog, toad, triton, and salamander) have very thick rods and very minute cones, but in each of the latter is a bright yellow or colourless globule situated between the outer and inner segment.

"9. The osseous fishes, so far as researches have hitherto gone, appear to possess rods and cones like the mammalia; and the latter are without coloured globules. Cartilaginous fish, on the other hand, as the ray and dog-fish, are wholly without 'cones,' like the bat among mammalia.

"10. The difference which in mammals and fish is so apparent

* It would be very interesting to examine the hare's retina, which, though so closely allied to the rabbit, differs so much from it in its habits.

in the relative thickness of the 'rod-' and 'cone-' filaments, is not apparent in birds or amphibia. How the case may be in those reptiles which possess both elements has not yet been ascertained."

The author then enters upon the question of the physiological relations of the "rods" and "cones;" and the following may be taken as a very brief summary of his highly interesting observations on this point.

The organization of the "yellow spot," and of the *fovea centralis*, in the human retina, clearly proves that the cones alone are not only sufficient for vision, but also that they possess certain physiological advantages over the "rods." But it is, at the same time, obvious that the "rods" alone suffice for the purpose of vision, since the bat and other mammals are wholly unprovided with "cones." But these mammals without cones in the retina prefer the dusk or night to daylight. The question, consequently, arises, what impression communicated through the retina in the dusk is useless?—by the solution of which we may be guided to some conclusion with regard to the peculiar function of the "cones."

The visual sense comprises three fundamental impressions, which have been termed by Aubert "Lichtsinn, "Farbensinn," and "Raumsinn;" that is to say, "light-sense," "colour-sense," and "space-sense." It as at once obvious that the light-sense, or the power simply of perceiving luminosity, including [perhaps] *quantitative* differences in the degree of light, is a fundamental requirement in any, even the simplest, visual organ. For this purpose, it is clear that a single termination of a nerve, or, in other words, in the case of the retina of the higher animals, a single rod or cone, would suffice. And it may also be admitted that a number of such visual points, associated so as to form a single percipient organ, would, in addition to the simple perception of light, also give the power of estimating space, and consequently of conveying ideas of form. These two faculties of the perception of light and of space as conveyed by light are inherent in the eyes of all vertebrates. The "coneless" retina of the bat, hedgehog, and mole, does not, in this respect, differ from the "rodless" retina of snakes and lizards, seeing that the "cones" are, at any rate, quite as fully percipient of light as the "rods," inasmuch as they equally represent the termination of sentient nerves. It may be assumed that the mere sense of luminosity is more strongly developed in nocturnal animals, as the bat, than it is in the sunshine-loving snake; so that the former would find a sufficiency of light when the latter was in darkness. This would seem to indicate that the "rods" were

more adapted for the simple perception of light than the "cones."

We have next to consider the *colour-sense;* that is to say, the sense by which *qualitative* differences in light are perceived. To judge from our own experience, which in such a question can be the only guide, the simplest trials will show that, as dusk and darkness approach, the power of perceiving colours ceases at a comparatively early stage. In the evening, though we may *see* objects well enough, we are quite uncertain as to their absolute or relative colour. We may suppose, therefore, that an animal which pursues its prey only at night, and which habitually frequents dark or obscure places, has no sense of colour, or, at any rate, only needs to distinguish different degrees of brightness in the different colours, as is the case with ourselves in the dusk [or even, in the case of colour-blindness, sometimes even in the daytime]. If we assume, as from the theory of Young and Helmholtz we are compelled to do, that the sense of colour resides in a determinate anatomical substratum, we are justified in concluding that that particular substratum is wanting in the retina of nocturnal animals. The conclusion naturally follows, that the "*cones*" *may*, in all probability, *be the terminal nerve-organs of the colour-sense.*

It should be borne in mind, however, that the "cones" cannot be regarded as *exclusively* confined to the perception of colour. The colour-sense necessarily includes the light-sense, or is, as it were, superadded to it; and thus we may conclude that, where the colour-percipient cones are sufficiently closely aggregated, they may also suffice for the *sense of space*, and thus fulfil all the functions of a retina by themselves alone. The only question, therefore, as M. Schultze remarks, that can arise, is as to whether it is probable that the "cones," together with the power of conveying impressions of luminosity and space, have not in addition that of conveying impressions of colour, and whether we have any reason, in like manner, to suppose that the "rods" have no such power.

The author then proceeds to show, in reference to the experiments of Purkinje, Hueck, Helmholtz, Aubert, and Schelske, that, although the sense of colour exists throughout the human retina, it is most acute in proportion to the preponderance or number of the "cones" over the "rods," and that the latter alone are unable to convey impressions of colour. He also points out that the probabilities that this function resides in the "cones" is strengthened by the fibrillated structure of the "cones" and their filaments, which is in accordance with the well-known theory of colour-

perception, propounded by Young and Helmholtz, that at least three different kinds of fibre must be required for this perception. Each "cone," therefore, in the mammalia and fishes, having this compound structure and all being alike, it would appear to follow that all are equally capable of perceiving every variety of colour. And his argument is still further strengthened by the consideration that, inasmuch as all or nearly all the "cones" in a bird's retina are furnished with a coloured spherule, through which all the light reaching the percipient part must pass, it would be absurd to suppose that they were incapable of receiving impressions of colour, for which, so far as shown by that circumstance, they alone would seem to be fitted. Furthermore, it is to be borne in mind that all the "cones" in a bird's eye do not contain spherules of the same colour, and that some are without any, whence we may conclude that in all probability the differently coloured "cones" are adapted for the perception of monochromatic light corresponding to that of the spherule contained in them, and that each is not, as in the mammal, capable of conveying equally impressions of all colours. And this view is curiously in accordance with the circumstance that the "cone"-filaments in the bird are scarcely thicker than those of the "rods." Whether this be the case with the filaments proceeding from the colourless "cones," has not been made out. But it may be that these "cones" are adapted for the reception only of the violet rays, which would, of course, be absorbed in their passage through the coloured "cones."

The structure of the owl's retina, in contrast with that of diurnal birds, may be cited in support of the same argument. And the author refers to a suggestion of his own, made in a former paper on the *macula lutea*,* that the intervention of the yellow spherule in birds, and of the yellow colour in the human *macula*, may serve for the interruption of the more powerful photo-chemical rays in their passage to the delicate percipient tissue.†

This part of the paper concludes with a highly interesting disquisition respecting several other points connected with the simple visual sense and the estimation of sizes and forms, &c., for which the reader must consult the original.

* 'Ueber den gelben Fleck der Retina,' &c. Bonn, 1866.

† Should M. Schultze's ingenious speculation respecting the use of the yellow and red spherules in the retina of birds and some sun-loving reptiles be entertained, it would seem to suggest the propriety of using yellow glasses to protect the eyes in strong daylight, as on snow or at sea in the tropics, for instance, instead of blue or violet ones, which transmit only the very rays which nature seems to be so solicitous to intercept.

In his researches on the retina M. Schultze has found the greatest advantage in the use of a solution containing 1 to $\frac{1}{10}$th of osmic acid (OsO_4); and he recommends that a solution of that substance containing 1 per cent. should be kept at hand, which can be diluted at pleasure. Microscopic preparations made with it he prefers to keep simply in water.

The black colour which is assumed by the preparation, even within a few minutes of its immersion, is at first uniform throughout. But subsequently the different parts of the retina exhibit slight differences, the optic nerve-fibres and the molecular and intergranular layers exhibiting the deepest tint. In frogs and fishes the deepest colour is seen in the outer segments of the "rods." In this way may be obtained preparations in which the outer segment is of a deep black colour, whilst the inner is almost uncoloured, the line of demarcation between the two being very abruptly defined. A similar difference is observable also in mammals, but not so constantly, and under circumstances which cannot at present be explained. But the demarcation between the segments is always well defined, and the author can recommend no better medium for the examination of the "rods" and "cones" than osmic acid. A special advantage of the osmic-acid solution is that it hardens the elements of the connective-tissue framework more slowly than the nervous; and another is that, except in very strong solutions, it does not produce granular coagulation either within or without the elementary parts of the retina.

The observer is cautioned against the injurious effects of osmic acid upon himself, unless great care be taken.

Another medium greatly employed by him is what he terms "Iod-serum," or iodized serum, which is used for the immersion of fresh dissections of the eye and other parts—the most delicate tissues, such as the retina, remaining for a long time unaltered in it. It is prepared from the amniotic fluid of the calf, to which a sufficient quantity of tincture of iodine is added to give it a faint yellow colour. And he has found that an albuminous fluid of this kind may be kept unaltered for any length of time if a very minute quantity of bromine be added to it. But as bromine acts very powerfully in causing cells, &c., to contract, the quantity added to the iodized serum must be less than will remove the whole of the yellow tint.

[It is not improbable that a few drops of carbolic acid would answer the same purpose as the bromine, and perhaps the iodine also.]

REVIEW.

Histoire Naturelle des Annelés marins et d'eau douce. Annélides et Gephyriens. By ARMAND DE QUATREFAGES.

THE worms of our seas and fresh waters—variously classified and arranged by those who have studied them—have commanded till quite recently but a very poor share of the attention of the working naturalist. The probable reasons of this circumstance are to be found in the retiring nature of these animals, and the comparative obscurity of the characters which separate them specifically and generically, as well as the difficulty of tracing their life-histories and anatomical development. We believe that we are not exaggerating the true state of the case when we say that there is not a single work extant, such as is available for other groups of animals, by which species of Annelida may be satisfactorily identified—even those occurring in such limited areas as our own and neighbouring seas. The few systematic works which are to be had, of which the British Museum Catalogue published in 1865 may be taken as a specimen, are simply useless for the purposes of the present day, owing to insufficiency in details in both descriptions and figures. On the other hand, the work of M. Malmgren on the Annelids of the North Sea, and such descriptions of species and ample drawings as those of Kinberg* and Ehlers,† are examples of the manner in which the Annelida should be treated; and until we get such works from many different localities the synonymy must remain in its present shocking condition, very many species which bear the same name in France, England, Germany, and Scandinavia, being quite distinct, and those bearing different names being often identical.

* Eugenie's Resa, &c., Zoologi, 1857.
† 'Die Borstenwürmer,' 1864.

The unfortunate worms have also been greatly ignored by the anatomist, the labours of Cuvier, Audouin and Edwards, Claparéde and De Quatrefages, leaving large gaps to be filled up; while, as regards external morphology, Professor Huxley * alone has made the attempt to advance upon Grube's useful though by no means perfect nomenclature.

Matters being thus, the announcement of a work on the annuloid animals of the sea and fresh waters by one who has laboured so successfully during the last twenty years at their anatomy as M. de Quatrefages, was a subject for great rejoicing to those interested in the group, and high expectations were raised. The work has at length appeared, in two volumes, with twenty illustrative plates. It does not treat of the whole sub-kingdom Annuloida (Annelés), nor of all worms which are sometimes classed as Annelida, but only of the *Polychæta appendiculata* and *Gymnocopa* of Grube, to which M. de Quatrefages restricts the class Annelida, and the *Gephyrea*, once regarded as Echinoderms; the other classes, embracing the earthworms, leeches, &c., are, we believe, to be discussed in other volumes by other authors.

We propose in the few following pages briefly to notice the various chapters of M. de Quatrefages' work, which we may at once state contains a vast amount of information, and numberless valuable facts, never before placed so readily to the hand of the naturalist. Much, indeed, of the matter is quite new, and the plates are for the most part very good, though sometimes over-coloured. While fully acknowledging the value of the work, we cannot but express some disappointment at the absence of any general views and philosophical exposition of the facts treated of in the first few chapters. The author appears as a most diligent observer, but fails to go beyond this. In the systematic portion of the work he has done great service in characterising all the known genera and most of the species of Annelida and Gephyrea; he has not, however, attempted to reduce the confusion in synonymy directly, and indirectly has added a little to it by not fully figuring and describing his new species.

In the Introduction the author defends his views on the classification of the Annuloida, or worms, which he divides primarily into two parallel series — the monœcious and diœcious—which contain groups presenting *analogies* to each other (the monœcious to the diœcious groups), but not *affinities* strictly so-called. In the following tables we give

* Lectures in 'Med. Times and Gaz.,' 1856.

M. de Quatrefages' classification, and that in Carus's 'Handbuch,' representing the last German view of these animals:

Vers.		Vermes.
Dioïques.	Monoïques.	Annulata.
Annelides.	*Erythrèmes* (*Oligochæta*).	
Rotateurs.		Gephyrea.
Géphyriens.		Chætognatha (Sagitta).
Malacobdelles.	*Bdelles* (*Hirudinea*).	
Miocœlés.	Turbellariés.	Nematelminthes.
Nematoïdes.		Platyelminthes.
	Cestoïdes.	

Those groups printed in italics in the left-hand table form the Annulata of Carus's arrangement.

It is an unfortunate thing for M. de Quatrefages' high estimate of the value of the unison or conjunction of the sexes as separating characters that Professor Huxley, some years since, described a small tubicolate Annelid which had the sexes united. M. de Quatrefages, while admitting this as rather an awkward hitch in his arrangement, contends that such an Annelid was only an accidental exception—one of those curious exceptions which prove the rule. This, we think, can hardly be maintained in the present very limited state of our knowledge of the reproductive organs of Annelida, and prefer such an arrangement as that of Carus, which should, however, include the Rotifera.

After thus clearing the way, the author proceeds to deal with the class Annelida as limited above.

His first chapter is devoted to "external organization," the remarks on the general form of the body and its division into regions being well worth perusal. The division into a fore part, a hind part, and a middle part—a head, a tail, and a thorax—exists in Annelids as in all animals of any complexity of organization; it is but faintly indicated in the errant Annelids whose thorax is not marked off from the tail, but in the sedentary forms is most obvious. M. de Quatrefages gives numerous details of the modifications of these parts, but hardly seems to recognise the fact that they are built up by the modification of homologous somites. In his review of the nomenclature of these various parts, and in particular those of the cephalic region, it is unfortunate that he has not noticed in any way the brief but most clear and philosophical view of the structure of Annelida given by Professor Huxley in the lectures already referred to. In all probability, M. de Quatrefages has never seen these lectures, which have been allowed to remain in comparative obscurity for more than ten years.

We have not space here to do more than glance at the morphology of the "cephalic region," as expounded by our author, which is the name he gives to the *kopflappen* and *mundsegment* of Grube taken together. All Annelids possess this "head," though in some of the sedentary forms it can only be distinguished by its appendages, while in the Errantia it is highly developed. The two parts of the head already distinguished by Grube and others he re-names, the first as "lobe cérébral," "tête," or "caput," the second as "anneau buccal" or "annulus buccalis." The names given by Professor Huxley to the same parts are respectively "prostomium" and "peristomium," names which we cannot but hope will be in the end generally adopted, as they have been already to some extent in Germany, since they express in the neatest form the most important relations of these two parts of the worm. The nomenclature of the appendages of the head is, M. de Quatrefages says, unsatisfactory, since appendages receive the same name in different Annelids which receive totally different nerves, and *vice versâ*. He considers that the distribution of the nerves should be made the criterion of homology in these parts in different genera, and we believe that he has here found the only test, save that of embryological relationship, which can be applied to such parts. The theory of the Annelid's head is in many ways analogous to that of the vertebrate skull.

The term "antennæ" is limited by our author to the appendages which are placed *on* the head properly so-called (kopflappen, prostomium); it is not always easy to ascertain what appendages are "placed on" the head, but we have a more tangible definition in this—"the antennæ receive their nerves directly from the brain itself (præ-oral or supra-œsophageal ganglia)."

The name "tentacula" is reserved for those appendages which proceed from the buccal ring; these receive their nerves from the ganglia of the "connective" or "accessory connective" (pharyngeal commissures).

The term "cirrhi tentaculares" is used to designate the appendages of the first feet when they assume the characters of the more strictly cephalic segments; these receive their nerves from the ventral chain of ganglia.

While these considerations are of value in recognising equivalent appendages in different genera and families, we cannot think M. de Quatrefages' choice of terms at all happy, since it rather tends to create confusion. Let us compare the corresponding titles used by different authors.

Audouin and Edwards.	*De Quatrefages.*
1. Antenne impaire ou médiane.	1. Antenne médiane.
2. Antennes mitoyennes.	2. Antennes latérales.
3. „ externes.	3. Tentacules inférieurs.
4. Cirrhes tentaculaires.	4. „ supérieurs.
5. „ „	5. Cirrhes tentaculaires.

Grube.	*Kinberg.*	*Huxley.*
1. Tentaculum impar.	1. Tentaculum.	1. Tentaculum prostomiale.
2. Tentacula media.	2. Antennæ.	2. Cirrhi prostomiales superiores.
3. Tentacula lateralia.	3. Palpi.	3. Cirrhi prostomiales inferiores.
4. Cirrhi tentaculares.	4. Cirrhi tentaculares.	4. Cirrhi peristomiales.
5.	5. Cirrhi buccales.	

Of these it will be seen that the terminology of M. de Quatrefages is only a modification of that of Audouin and Edwards. It is an important modification, however, since he couples the third pair of appendages with the fourth, whilst the other authors, with the exception of Kinberg, couple them with the second. Kinberg's names are extremely short and useful, but do not express any of the relations of the parts. Professor Huxley's names are valuable, since they serve to enforce the idea that each of these pairs of appendages correspond to the appendages—the cirrhi—of a somite. If we are to have a simple nomenclature, short, for use, we prefer Kinberg's ; but if by the names given it is desirable to express the homologies of the parts, those of Professor Huxley are the best. M. de Quatrefages does not discuss in any way the structure of the prostomium and peristomium as consisting of modified somites ; and hence, though on account of the origin of their nerves he associates with the appendages of the peristomium, in name, what all other authors appear to have regarded as one pair of the appendages of the prostomium, we are at a loss to know whether he really considers the third pair of appendages, the "palpi" of Kinberg, as belonging morphologically to that portion of the head in front of the mouth or to that portion around it. The omission of any attempt to discuss this question of the structure of the cephalic region is very much to be regretted.

Applying his principle of "antenna" and "tentaculum" to the sedentary forms, the author shows that in Terebella the prehensile cirrhi are modified "antennæ," as also are the respiratory fans of Sabella and Serpula, whilst the opercula of Hermella, &c., arising from the peristomium—the buccal ring—are the homologues* of the tentacula or peristomial cirrhi.

* M. de Quatrefages says "les analogues;" but here, as elsewhere, we observe that the terms "homologue" and "analogue" have not with him

The modifications of the appendages of the feet in the thoracic and abdominal regions of the body are more carefully discussed. The elytra of Aphroditaceæ are considered as respiratory organs—certainly not homologous with the notopodial cirrhi, since in some genera they exist on the same somite with the notopodial cirrhi, as shown by Audouin and Edwards. There can, however, be little doubt that there is a very intimate relation between elytra and cirrhi, both in structure and function, the absence of cirrhi on those somites provided with elytra in most Polynoïna sufficiently proving this. The elytra are described by M. de Quatrefages as composed of two lamellæ, in the space between which the fluids from the general cavity of the body circulate, passing in by a fine aperture in the pedicle of the scale. The cirrhi are described as more or less cylindrical and tapering appendages, whose function is that of an obscure sense of touch, similar to that of the "whiskers" of certain mammifers. Now, though this description of elytra and cirrhi is true for general purposes, it does not state the whole case. In many Polynoïna the two lamellæ of the elytra are rendered entirely continuous by a tough, fibrous, intermediate structure, similar to that which in most cases forms the central portion of a cirrhus; no passage is thus left for the circulation of fluids, and a hard leather-like plate is formed, on the surface of which are papillæ, having, to all appearance, a sensory function. On the other hand, the cirrhi in some Polynoïna (*Antinoë nobilis*, from the Channel Islands, and the *Gastrolepidia* of Schmarda) are excavated, and form delicate bladder-like sacs, communicating with the general cavity of the body, whilst the foliaceous form and respiratory function of the cirrhi in Phyllodoce are well known.

The chapter on external form concludes with a minute description of the various forms of setæ and hooklets met with in the Annelida.

The second chapter, devoted to anatomy and physiology, is, perhaps, the most valuable in the work, since in it a *résumé* is given of those numerous and excellent essays of the author on various genera of Annelida already published, whilst there is much additional matter. It would have made the work more valuable had not the author dwelt so entirely on his own observations, and noticed more fully those of other writers. A large portion of this chapter is, we regret to see, necessarily taken up in controverting the claims and opinions

the same definite sense of structural and functional equivalent which they have gained in England.

of our late unfortunate countryman, Dr. Williams, of Swansea, who M. de Quatrefages seems to think is regarded by other observers as a credible and sound investigator. This we can assure him is not the case in England. There is, however, one great merit due to Dr. Williams which ought to be universally acknowledged, as it is by M. de Quatrefages; it is that of having first discovered and appreciated those excretory ducts to which he applied the name "segmental organ." When we have given credit for this to Dr. Williams, it is all we can do for him; for the "segmental organ" appears really to have worked upon his brain in a most serious way, and rendered him truly monomaniacal. All the lower animals, he attempted to show, possessed this "segmental organ;" it was from this that the generative glands were developed, &c., and in order to support these statements he published most extraordinary drawings of dissections (which happily very few people believe in now), and treated the most distinguished writers, whose views differed from his, with contempt or abuse. M. de Quatrefages undoubtedly drew attention to the nature and functions of the general cavity of the bodies of Invertebrata before Dr. Williams, and throughout the researches of the former on the circulation and respiration of Annelida have precedence over those of the latter.

The various organs of the Annelida are treated in this chapter of 100 pages under the following heads:—1. *Teguments and general muscular system.* 2. *General cavity of the body.* 3. *Organs and functions of digestion.*—The description of the exsertile pharynx and its teeth and denticles in various genera is a specimen of the author's great attention to details, and his minute acquaintance with these structures from personal observation. We cannot, however, agree to the statement that the pharynx is ever entirely everted in life by the Polynoïna, which is, indeed, put forward somewhat doubtfully; it seems to be merely owing to a strong convulsive action of the muscles that this takes place, generally resulting from such an irritation as causes death; and we doubt if the pharynx is ever withdrawn again, since the worm dies almost directly after its protrusion. 4. *Organs and functions of absorption.*—Under this heading the author states "there are no special organs of absorption." He assigns this function to the vessels of the red fluid which are intimately connected with the intestine. 5. *Organs and functions of circulation.* 6. *Organs and functions of respiration.*—Treated separately as the respiration of the blood (red vascular fluid), and respiration of the liquid of the general cavity. These two

subjects of circulation and respiration are discussed very fully. The researches of Milne-Edwards were the first in elucidating this portion of the anatomy of the Annelida; and it almost seems to have become specially appropriated to the investigation of French naturalists. 7. *Organs and functions of secretion.*—Under this head the abundant secretion of viscid material from the skin, such as is observed in *Lumbrinereis, Cirrhatulus, Chætopterus,* and all tube-building forms, is briefly discussed. 8. *Organs and functions of innervation.*—The nervous system is described as consisting of a general and a visceral system, the first comprising the "brain," or large bifid supra-œsophageal mass and the ventral chain of ganglia; the second of a chain or series of stomato-gastric ganglia, variously modified in the different genera. 9. *Organs of the senses.*—The sense of touch is very briefly passed over, very little being said as to the sensitive papillæ and hair-like appendages of some Annelids. The author inclines to the belief that the Nereides possess the sense of taste, from the structure of the pharynx, but no evidence is adduced from other Annelids. The organ of hearing, first recognised by Grube and Siebold in *Arenicola,* is considered by M. de Quatrefages the only well-attested example of such a structure in Annelida. Carus, however, in his 'Handbuch' (1864) regards all Annelids as possessing such organs. M. de Quatrefages says he has twice observed some such organ in *Eunice sanguinea,* but he does not feel sufficiently certain of its nature. The eye is well developed in many Annelids, as the researches of Muller, Wagner, Rathke, Siebold, and chiefly M. de Quatrefages himself, attest. The curious genera *Amphicorine* and *Polyophthalmus,* the one with eyes at the tail, the other with an eye to each ring of the body, are refigured and described. 9. *Organs and functions of locomotion.*—The explanation offered of the mode of action of the feet in those Annelids in which they are developed as locomotory organs is worth notice. A very large share of importance is ascribed to the fluid of the general cavity, in relation to locomotion. It acts by distending the erectile tissue of the feet, and also stiffens each part of the body successively in a similar manner, thus giving a *point d'appui* to the muscles which are attached to those parts. 11. *Organs and functions of generation.*—The different subjects coming under this head—ovaries, spermatozoa, accessory organs, &c.—are treated at some length. The modifications which the embryo undergoes, and the subsequent phenomena of alternating generation, or geneagenesis, as M. de Quatrefages calls it, are discussed as far as the facts at

hand will allow. The embryogeny of the Annelida is, indeed, a field of study which has been but little entered on, and which is most urgently in need of workers. M. de Quatrefages himself has traced the development of *Hermella*, and gives a *résumé* of his work in this chapter. We may here call to mind Busch and Müller's arrangement of the different larval stages of Annelida into Telotrocha, Mesotrocha, Polytrocha, and Atrocha, according to the varying development of the ciliated rings which characterise these larvæ. Claparéde has lately attempted a more complete classification, dividing the larvæ into two large primary groups—Matachætæ and Perennichætæ, the first of which is subdivided into the three groups Gasterotrochæ, Nototrochæ, Amphitrochæ; the second into Cephalotrochæ, Polytrochæ, Atrochæ.

M. de Quatrefages does not at all like this classification of Claparéde's, since, a Polytrocha becoming an Atrocha in the course of development, and other similar changes occurring, his nomenclature will only give rise to confusion. He further observes very truly that we know very few facts relating to this subject, the larvæ of scarcely thirty species having been examined. He gives a list of these species, and references to the papers in which they are described. This list is really so valuable to any one who wishes to carry on investigations in this branch of inquiry, that we copy it here in full.

APHRODITEA.—*Polynoë cirrata*.—Sars, 'Wiegm. Archiv,' 1845, i, p. 11.

Polynoë cirrata.—Max Müller, 'Müller's Archiv,' 1851, p. 23. Désor, 'Boston Journ. Nat. Hist.,' vol. vi, p. 12.

Polynoë.—Claparéde, 'Beobacht. über Anat. und Entwick. Wirbell. Th.,' p. 80, pl. 8, figs. 7—11.

EUNICEA.—*Eunice sanguinea*.—Koch, "Ein Worte zur Entwick. von Eunice" ('N. Deukschr. der Schweiz. Gesch.,' vol. vii).

LYCORIDEA.—*Nereis diversicolor*.—Max Schultze, 'Abhandl. der naturforsk. Gesellsch. zu Halle,' vol. v, p. 213.

Nereis.—Milne-Edwards, 'Ann. des Sci. Nat.,' 3rd ser., vol. iii.

PHYLLODOCEA.—*Phyllodoce*.—Max Müller, 'Müller's Archiv,' 1855, p. 17.

SYLLIDEA.—*Syllis pulligera*.—Krohn, 'Wiegm. Archiv,' 1852, p. 251.

Autolytus prolifer.—Krohn, 'Wiegm. Archiv,' 1852, p. 66. 'Müller's Archiv,' 1855, p. 489.

Autolytus cornutus.—A. Agassiz, 'Journ. of Boston Soc.,' vol. vii, 1862, p. 392.

Sacconereis helgolandlica.—J. Müller, 'Müller's Archiv,' 1855, p. 13. Mac Schultze, loc. cit., fig. 10.

Sacconereis Schultzii.—J. Müller, loc. cit., p. 7.

Cystonereis Edwardsii.—Kölliker (Koch, loc. cit.).

Exogone naïdina.—Œrsted, 'Wiegm. Archiv,' 1845, p. 20.

Odontosyllis.—Claparéde, loc. cit., p. 81.

ARICIEA. — *Nerine longirostris.* — Leuckart, 'Wiegm. Archiv,' 1855, i, pp. 63 and 77. Busch, 'Beobacht. über Anat. und Entwick. ein Wirb. Th.,' pl. 8.

Leucodore ciliata.—Œrsted, 'Ann. Dan. Conspectus,' p. 39, pl. 6. Claparéde, loc. cit., p. 69, pls. 7, 8. "Annélides voisines de la précédente," Claparéde, ibid.

Magelona papillicornis.—Claparéde, loc. cit., p. 74.

TELETHUSA.—*Arenicola piscatorum.*—Max Schultze, 'Abhandl. naturforsk. Gesellsch. zu Halle,' vol. v, p. 213.

TEREBELLACEA. — *Terebella nebulosa.* — Milne-Edwards, 'Ann. des Sc. Nat.,' 3rd ser., vol. iii, p. 145 (1845).

Terebella conchilega.—Claparéde, loc. cit., p. 63.

HERMELLACEA.—*Hermella alveolata.*—Quatrefages, 'Ann. des Sc. Nat.,' 3rd ser., vol. x, 1848, p. 153.

SERPULACEA.—*Protula.*—Milne-Edwards, loc. cit., p. 161.

Fabricia.—O. Schmidt, 'N. Beiträge zur Naturg.,' p. 27.

Spirorbis spirillum.—Pagenstecher, 'Zeitschr. fur wiss. Zool.,' 1862, vol. xii, p. 486.

CHÆTOPTEREA. — *Chætopterus.* — J. Müller, 'Müller's Archiv,' 1846, p. 101. Busch., 'Müller's Archiv,' 1847, p. 187; and 'Beobacht.,' 1851, p. 59. Max Müller, 'Obs. Anat. de Verm. quib. mar.,' p. 25, pl. 3; and 'Müller's Archiv,' 1855, p. 1.

We must pass over the pages on the fissiparous reproduction of Annelida, and their growth and death, in which, as elsewhere, the author dwells chiefly on his own researches published from time to time in the 'Annales des Sciences Naturelles;' and, indeed, the whole chapter on anatomy and physiology is little more than a *résumé* of those researches, which, though valuable and good, still are not the whole of what has been done. The four plates illustrative of this part of the work are very good for small plates, but are not quite so numerous as might be wished, nor do they equal the drawings of Ehlers in execution.

The third chapter is entitled "Natural History," and deals with the habits of Annelida in freedom and captivity. There are many interesting observations in this short chapter.

The fourth chapter is devoted to geographical distribution. The author observes that but little is known of the distribution in the world of Annelids; but that from the researches

of Schmarda and Kinberg, it appears that many genera are cosmopolitan. He dwells upon his notion that the Oligochæta *represent* what he calls the true Annelida—the Polychæta; the former being fresh-water and terrestrial forms, the latter always marine. Holding this view, he is led to doubt the occurrence of Naids on the sea-shore, such as the *Pachydrilus* and *Clitellio arenarius* described by Claparéde. He suggests that a spring running down to the sea might account for their appearance, but cannot believe that they are marine. We ourselves, last summer, met with *Clitellio arenarius* at low-water mark in the Isle of Man, and the circumstances attending its occurrence were precisely those suggested by M. de Quartrefages. A small fresh-water spring ran into the sea at the point where Clitellio occurred, and spread itself over the sands.

In the fifth chapter, on the "History and Zoological Relations" of the group, the literature of the Annelida, and the various arrangements of the class which have from time to time been offered, are discussed from their earliest day. We cannot here pass in review the systems of all those who have attempted to arrange Annelids into natural groups, but we may compare the divisions of Cuvier, Grube, and M. de Quatrefages. The latter states that he has chiefly occupied himself in limiting the families or small assemblages of genera, which he considers of fundamental importance, representing, as they do, the Linnean genera. While Grube, with Cuvier, embraces in his class Annelida the leeches and earth-worms, as well as the marine setigerous forms, M. de Quatrefages, it will be remembered, only allows the latter to come under this class, separating the other groups as distinct classes. Other writers, again, have gone so far in the other direction as to include nearly all worms—the Turbellaria, Gephyrea, &c.—under this class Annelida. Cuvier took for the basis of his subdivisions the absence or the presence of respiratory organs. Savigny neglected this character, and founded his classification, in the first place, on the absence or presence of setæ, on the structure of these parts, on the presence or absence of a distinct head, antennæ, pharynx, and jaws. Blainville took above all things the general form of the body, the similarity or dissimilarity of the rings, the greater or less complication of their appendages. Audouin and Edwards applied themselves chiefly to the modifications of the soft appendages, and regarded considerations drawn from the respiratory organs as of secondary importance. Grube occupied himself chiefly with the nature and development of the hard parts which arm the feet. M. de Quatre-

fages states that, in arranging his limited groups of Annelids, he has endeavoured to take all characters into consideration, and not to be exclusively guided by any one special set of *differentia.*

Cuvier.—ANNÉLIDDES.	Tubicoles. (Limivora of Grube.)	Dorsibranches. (Rapacia of Grube.)	Abranches. (Oligochæta and Discophora of Grube.)

Grube.— *Class* ANNELIDA.

Ord. Appendiculata Polychæta. (All the marine setigerous worms.)	Gymnocopa. (Tomopteris only.)	Onychophora. (Peripatus only.)	Oligochæta. (Earthworms.)	Discophora. (Leeches.)

Grube divides his Polychæta thus:

RAPACIA, with the families *Aphroditea, Amphinomea, Nephtydea, Glycerea, Phyllodocea, Lycoridea, Amytidea, Eunicea, Ariciea, Syllidea.*

LIMIVORA, with the families *Chætopterea, Pherusea, Maldania, Opheliacea, Telethusa, Terebellacea, Hermellacea, Serpulacea.*

M. de Quatrefages' class Annelida, the relations of which to the other groups of his Annelés (Annuloida) may be seen by the table at the beginning of this article, is thus divided:

Order 1. ERRATICÆ.		Order 2. SEDENTARIÆ.	
Sub-Order 1. Erraticæ aberrantes.	*Sub-Order* 2. Erraticæ propriæ.	*Sub-Order* 3. Sedentariæ aberrantes.	*Sub-Order* 4. Sedentariæ propriæ.
Fam.	Fam.	Fam.	Fam.
1. *Aphroditea.*	1. *Eunicea.*	1. *Chetopterea.*	1. *Tomopteridea.*
2. *Palmyrea.*	2. *Lumbrinerea.*		2. *Clymenea.*
	3. *Amphinomea.*		3. *Arenicolea.*
	4. *Nephtydea.*		4. *Ophelea.*
	5. *Nerinea.*		5. *Aricea.*
	6. *Cirrhatulea.*		6. *Leucodorea.*
	7. *Chloremea.*		7. *Hermellea.*
	8. *Nereidea.*		8. *Pectinairea.*
	9. *Syllidea.*		9. *Terebellea.*
	10. *Hesionea.*		10. *Serpulea.*
	11. *Phyllodocea.*		
	12. *Glycerea.*		
	13. *Polyophthalmea.*		

This arrangement of the families has much to recommend it, although there may be grounds for objection here and there. It is infinitely better, in a systematic work, that small and numerous groups should be made, than that large and roughly defined assemblages of genera should be treated as families. M. de Quatrefages has shown great conscientious-

ness in leaving many genera as "*incertæ sedis*," rather than force them into a position which he did not feel sure naturally was theirs.

We now come to the chief part of the work, the systematic description of the families, genera, and species. There are many new genera introduced, and new arrangements of species advocated, which we cannot here examine; and, indeed, they will be best appreciated by a study of the work itself. M. Claparéde has already criticised some points in the arrangement of genera very fully, which has given rise to a rather sharp contest in the 'Comptes Rendus' of the French Academy. The family of Syllidea appear to be the great cause of discussion, which present great difficulties to the naturalist by their metamorphoses and alternation of generations, the same species appearing under very different phases. Many new species are described and figured in the work from the collection of the museum; and here we must object to the frequent insufficiency of descriptions and figures. In several cases—*e.g. Polynoë setosissima* and *Aphrodita talpa*—the most characteristic parts of the worm are not figured, but merely a general view of the animal is given; and, moreover, in a large number of cases no figure at all is given of the worm described. This cannot but cause difficulty to other zoologists, and is much to be regretted. The figures of species, we notice, moreover, are not infrequently over-coloured—*e.g. Hermione hystrix* and *Chætopterus Valencinii*. With regard to the Chætopterus of our coasts, M. de Quatrefages re-names it without any compunction, though it has been described and figured most fully in the 'Linnean Transactions' by Dr. Baird as *Chetopterus insignis*. The author was, however, most probably, not aware of this, since these descriptions of species have been in hand for some years. At the same time, there is no evidence in the book of any careful bibliographical research, with a view to reducing the confusion of names at present existing, or even avoiding its increase.

The class Gephyrea, which owes its establishment to the labours of M. de Quatrefages, is treated of in the last 114 pages of the second volume, and in proportion to the size of the group this part of the work will, perhaps, be more valuable to the naturalist than that on the Annelida. This class of Vermes, at present so little known, is discussed in much the same manner as the Annelida, through which we have just passed, and is illustrated in the same way.

Before taking leave of this book we wish again to express our conviction that it will be found of great value to the zoologist and anatomist, since it contains nearly all the

author's original observations rewritten, descriptions of many new species, and many beautiful figures. At the same time, we feel that there is ample scope for a more detailed systematic work, and that the introductory portion is by no means fully up to the time as a special treatise on the anatomy of Annelida.

QUARTERLY CHRONICLE OF MICROSCOPICAL SCIENCE.

GERMANY.—**Kölliker's und Siebold's Zeitschrift.** Third Part, 1866.—"*New Infusoria in a Sea Aquarium,*" by Dr. Ferdinand Cohn, of Breslau.—After some interesting remarks of a general character on the structure of Infusoria, Dr. Cohn proceeds to describe at some length the following species of Infusoria observed by him:—1. *Trachelocerca Phœnicopterus,* n. sp. 2. *Lacrymaria Lagenula,* Clap. and Lachm. *Metacystis truncata,* nov. gen. et spec. *Nassula microstoma,* n. sp. *Placus striatus,* nov. gen. et spec. *Amphileptus Gutta,* n. sp. *Lembus velifer,* nov. gen. et spec. *Anophrys sarcophaga,* nov. gen. et spec. *Colpoda pigerrima,* n. sp. *Uronema marinum,* Duj. *Pleuronema Citrullus,* n. sp. *Helicastoma oblongum,* nov. gen. et spec. *Loxophyllum rostratum,* n. sp. *Actinotricha saltans,* nov. gen. et spec. *Stichochæta pediculiformis,* n. sp. *Oxytricha scutellum,* n. sp. *Oxytricha flava,* n. sp.; var. *carnea.* *Oxytricha rubra,* Ehr. *Trichodina Auerbachii,* n. sp. *Acarella Siro,* nov. gen. et spec. *Cothurnia Pupa,* Eichw. *Glyphidium marinum,* Fresenius. These numerous genera and species are figured with great clearness in two finely executed large folding plates. The paper is an admirable example of what may be done by a good microscopist simply working at what lies under his hand—the inhabitants of an aquarium. Dr. Cohn's aquarium was set up, he states, for the purpose of studying marine Algæ, and these Infusoria were accidentally observed.

"*On Hemioniscus, a New Genus of Parasitic Isopods,*" by Dr. R. Buchholz.—This very interesting crustacean was observed at Christinasand, in the bottom of a vessel in which a number of *Balani* (*B. ovularis,* Lamk.) had been placed. They presented at first the appearance of some Annuloid animal; but their true nature was soon revealed by the use of the microscope, and their history afterwards traced. Dr.

Buchholz places *Hemioniscus* in the family Bopyridæ (Epicaridæ, Latr.). The anatomy and development of the female animal are fully described and illustrated by two coloured plates.

"*On Coscinosphæra ciliosa, a new Radiolarian,*" by Alexander Stuart, of Petersburg.—This Rhizopod is placed by the author in Häckel's family Ethmosphærida, which he divides into three sub-families:—1. Coscinosphærida, containing this new genus *Coscinosphæra*. 2. Heliosphærida, with the genera *Cyrtidosphæra, Ethmosphæra, Heliosphæra*. 3. Arachnosphærida, comprising two genera, *Diplosphæra* and *Arachnosphæra*. The characters of this new form are described, and its affinities discussed at length, and a plate illustrates the paper.

"*Apsilus lentiformis, a Rotifer,*" by Elias Mecznikow.—The energetic author of this paper states that at Giessen, on the under side of leaves of *Nymphæa lutea*, he met with large numbers of white lenticular bodies, which, on close examination, proved to be Rotifers of a kind at present unknown. The adult female of this remarkable form appears, when expanded, to consist of two nearly equal circular sacs, the anterior of which is open, forming the mouth, and is destitute of any "wheel-apparatus;" it possesses at the same time a mastax, well-marked "water-vessels," and reproductive organs. The young female differs totally from the adult in the possession of a ciliary apparatus, distinct eyes, and in its free habit of life. The adult male is, as in other Rotifers, quite unlike the female. He has a broad, ciliated, oral extremity, provided with eyes, and apparently a large præ-oral ganglion, whilst his body gradually tapers to a point posteriorly, provided with a few cilia. The writer in the 'Zoological Record for 1865' had no paper to report upon from the class Rotifera: we congratulate him upon having here a very interesting one. Herr Mecznikow concludes his paper with some remarks on the affinities of Rotifera. In his paper "*On Icthydina, &c.,*" translated in the last number of this Journal, it will be remembered that he advocated the juxtaposition of the *Chætonoti* and *Rotifers*, the one to be called *Gastrotricha*, and the other *Cephalotricha*. At the same time, he appeared to object to the notion that the Rotifera (*Cephalotricha*) represented the larval stage of Annelida. In this paper he shows the strong resemblance which subsists between many *Gastrotricha* and Annelid-larva, and mentions his discovery at Göttingen of a *Notommata* (Rotifer) which had ventral cilia, as a proof of the relationship of *Chætonoti* and *Rotifera*. The genus *Dinophilus*, which is closely related to

Icthydium, bears, he states, a very close resemblance to the larva of the Annelid *Lysidice*, which he has observed at Naples, and which will be more fully described at a future time with other Annelid-larvæ. He gives, as his final opinion, that *Dinophilus* (and hence, we suppose, the allied groups, *Cephalotricha* and *Gasterotricha* generally) is to be regarded as a stationary Annelid-larva, bearing the same relation to Annelida as *Appendicularia* to the Ascidians—the view originally put forward by Professor Huxley in this Journal.

"*On a Fresh-water Crustacean in the Nile,*" by Dr. C. B. Klunzniger.

"*On the Kidneys of Tropidonotus natrix and of the Cyprinoids,*" by O. Gampert.—This is a short paper, with a well-drawn plate, by a pupil of Professor Frey. A few interesting notes are given on the structure, dimensions, &c., of the tubuli and vessels of the kidney in the commonring-snake and carps.

"*On Cohnheim's 'Compartments' in the Cross-section of Muscles,*" by A. Kölliker.—This paper relates to the arrangement of muscular tissue in separate bundles, which Dr. Cohnheim, in 'Virchow's Archiv' for 1865, described at some length, making his observations by freezing the muscle and cutting it across the fibre, when a mosaic-like disposition becomes apparent. Professor Kölliker had misunderstood this structure in 1856, and now returns to its study with the improved instrument of 1866. He concludes, from numerous considerations adduced, that the muscular bundles possess really a fasciculate (faserigen) structure, or that the parts which bind together the sarcous elements in the longitudinal direction have not the same character as the cross-binding middle portion and the substance between Cohnheim's "compartments;" also that the muscular columns (muskeläulchen) are still further held together, and consist of fibrillæ and very scanty intervening substance. In another part of our Chronicle is an abstract of some notes by Dr .McNamara on the same subject.

Max Schultze's Archiv f. Mikr. Anat. Second and Third Parts, 1866.—The bulk of this double number is occupied by a paper by Professor Schultze "*On the Retina,*" of which a long notice is given among our translations. The other memoirs in this number are—

"*Contributions to the Natural History of the Infusoria,*" by Dr. W. Zenker.

"*Description of a Live-box for the observation of Living Tadpoles and other Animals,*" by F. E. Schultze, of Rostock.

"*On the Sculpture of Gyrosigma,*" with a plate, by M. Schiff, of Florence.

"*On some Amœbæ living in the Earth, and other Rhizopods*" (two plates), by Dr. Richard Greef.

"*Bony Bodies with Special Capsules in the Tooth-pulp*" (with figures), by Dr. Hohl.

"*On the Contractile Tunic of Infusoria,*" by Dr. Schwalbe.

"*On the Influence of Gases on Ciliary Movement,*" by Herr Kuhne.

FRANCE.—**Comptes Rendus.**— "*The Microscope and Gas-diffusion.*"—Mr. Graham, the Master of the Mint, communicated an account of his researches on the dialysis of gases to the French Academy a short time since. His latest experiments were made relative to the passage of gases through thin membranes of india rubber; and believing the india-rubber sheeting to be perfectly imperforate, he concluded that the passage of the gas was effected by a chemical union with the hydrocarbons of the india rubber. M. Flourens, however, of the French Academy, has examined thin india rubber with the microscope, and declares that innumerable minute perforations are to be traced in it, through which the gas would pass by capillary transpiration. It is certainly desirable that further examination of the matter should be made; meanwhile microscopists may congratulate themselves upon a new field for their instrument.

Robin's Journal de l'Anatomie et de la Physiologie. No. 6. November and December.—This journal appears to be conducted in somewhat the same manner as our own, since it publishes the transactions of the Micrographic Society of Paris in addition to other original memoirs and short notes or reviews. The first paper in the current number (the journal appears six times in the year) is on—

"*Anatomical Lesions of the Enamel and Dentine,*" by M. E. Magitot.—In this paper the microscopic structure of the teeth in caries is very fully figured and described, and the pathological and physiological bearings of the disease discussed.

"*On the Lymphatic Vessels, &c.—Additional Note,*" by Dr. Belaieff.—This is a continuation of the paper which we noticed in our last Chronicle.

"*Researches on the Corpuscles of the Pébrine,*" by Dr. Balbiani.—The author was one of those appointed to investigate the disease of the silkworms for the French Academy. Certain corpuscles had been noticed as always present in great numbers in the fluids of the diseased worms, and had been variously described. Dr. Balbiani has examined them, and believes them to be Psorosperms—pseudo-naviculæ of some Gregarina. He regards them as *vegetable* parasite

and states that he has found them in other insects and also in Entomostraca. In the same way as most other animal and vegetable parisites, these corpuscles do not constitute a cause of danger for the health or even for the life of the individuals in which they develop themselves; but their excessive multiplication brings on functional disorders of a serious nature in the organs which they have invaded. The author further notes that the egg of a psorospermic Bombyx has an acid reaction, whilst that of a healthy one has a slightly alkaline effect; and he concludes that the psorosperms are in some way intimately connected with this acid condition. The *Gregarinida* seem daily acquiring more importance, extending their range of victims in every direction, and yet very little is known of the group.

"*The Spiral Lamella of the Helix of the Ear*," by Dr. Loewenberg.—This is the first part of an extensive essay, already amounting to forty pages and two plates. The microscopic structures of the numerous elements of the innermost ear are successively described. The paper does not appear to contain much new matter, but, like that on caries above mentioned, is a very useful paper to one who works with the microscope.

"*The Micrographic Society of Paris*."—The statutes of this society, which is apparently but just founded, are published in the journal. M. Charles Robin is the president, M. Balbiani the vice-president. At present it numbers about thirty members, most of whom appear to be anatomists and medical men. We wish this society every success, and hope that it may be productive of some good work, as it seems likely to be. At the last meeting a paper was read by M. Kanver "*On the Structure of Subungual Exostosis*," which is an interesting pathological essay. We suspect that the new society will be almost entirely devoted to the investigation of human histology.

ENGLAND.—**Annals and Magazine of Natural History.** October.—"*On New British Hydroida*," by the Rev. T. Hincks.—The species that are briefly characterised in this paper will be more fully described and figured in the general history of the British Hydroid Zoophytes on which Mr. Hincks is engaged. The species are *Coryne vermicularis*, from deep water off Shetland, *Campanularia flabellata*, which is set down as a new species at the same time that the *C. gelatinosa* of Van Beneden is said to be a synonym of it. How can this be? This species occurs at Tenby in tide-pools, and off Scotland. *C. gigantea*, Lamlash Bay, on shell. *Gonothyræa hyalina*, Shetland. *Cuspidella* (nov. gen.) *humilis*,

on the stems of zoophytes, North Wales, Yorkshire, Shetland, &c. *Sertularia attenuata,* North Devon, Yorkshire. Besides these new species, Mr. Hincks has to record *Clava leptostyla,* Agassiz, from Morecambe Bay, and *Gonothyræa gracilis,* Sars, from Connemara.

November.—Mr. Hincks describes in this number a new genus of Sertularian Hydroids—*Ophiodes.* The single species *O. mirabilis* was dredged by Mr. Hincks in Swanage Bay, Dorset, on weed in shallow water, where it was not uncommon.

"*Notulæ Lichenologicæ.*"—The Rev. W. A. Leighton continues his papers on Lichens. He is now advocating the use of hydrate of potash in discriminating between species, since different species give different colours and other reactions when treated with this agent. He has found it particularly useful in deciphering the difficult tribe of *Cladoniei.*

Journal of Anatomy and Physiology.—This is a new periodical, to be published half-yearly, of royal octavo size, and largely illustrated. It is conducted by Professors Humphry and Newton of Cambridge, Dr. E. P. Wright of Dublin, Dr. Turner of Edinburgh, and Mr. Clarke of Trinity College, Cambridge. It may in some way be regarded as a successor to the 'Natural History Review,' which we much regret has ceased publication, two names at least passing from the cover of the one to the other. We believe that the principal reason of the Cambridge professors for entering into the publication is to gain for their university, if possible, a reputation for showing some little regard for biological science, more especially in its medical aspects. The utter indifference of Cambridge to the progress of any science that is not mathematical is, however, too well known, and more substantial proofs of her interest than a new journal are required. There are two microscopical papers in this very excellent magazine, illustrated by numerous plates.

"*On the Structure of the Cornea in Vertebrates,*" by Dr. Lightbody.—This is a very careful résumé of the work of previous observers, to which the author has most conscientiously added his own observations, confirmatory or otherwise. This paper formed part of a thesis presented to the medical faculty at Edinburgh in 1865, for which a gold medal was awarded.

"*On the Retina of Amphibia, &c.,*" by Dr. Hulke.—There are some noteworthy remarks on the retina of the chameleon in this paper, as well as on those of Amphibia. Whilst the six plates illustrating Dr. Lightbody's paper are done fairly well, though wanting in sharpness, those illustrating this paper

of Dr. Hulke's are among the roughest pen-and-ink sketches we ever saw lithographed. How is it that even a new journal, with every opportunity, such as this is, cannot find an artist who will produce a plate fit to be compared with those issued in German periodicals?

Journal of Botany.—In the September number of this magazine is a paper "*On Pollen-grains as Diagnostic Characters,*" by Professor Gulliver. He shows that a microscopic examination of the pollen may afford good diagnoses between closely allied species. Of two plants, standing side by side in our Flora, the pollen-grains of *Ranunculus arvenis* are large, and rough on the surface, while those of *R. hirsutus* are much smaller, and smooth on the surface.

A new distinction also appears in the pollen between *Lotus corniculatus* and *L. major,* the pollen-grains being regularly larger in the former than in the latter plant. This curious fact, if confirmed, will be in direct opposition to the conclusion of many eminent botanists, that *L. major* is "only a variety, larger in all its parts," of *L. corniculatus.*

"*On the Frond-cells of Lemna and Wolffia.*"—The same observer, in the December number, states that there is this remarkable microscopic difference between *Wolffia arrhiza* (lately discovered in this country by Dr. Henry Trimen) and *Lemna minor;* the latter abounds in raphides, while the former has none at all.

Medical Times and Gazette. Nov. 17th.—"*Striped Muscle,*" by C. Macnamara, M.D., Surgeon to the Calcutta Ophthalmic Hospital.—When a man comes forward and says, "I have been working with a $\frac{1}{50}$th objective," and speaks of "twelfths" and "twentieths" as low powers, his observations cannot fail to interest the readers of this Journal. We therefore extract here the greater part of a paper by such an author; at the same time, we by no means give our sanction to, nor are we in a position to reject, his statements, which are certainly remarkable in some ways:

"During the past ten years I have been working more or less steadily with one of Ross's eighth and one sixteenth of an inch glass, but within the last six months with a Powell and Lealand's one fiftieth of an inch, magnifying about 2800 diameters, and with it the observations I have now to detail have been made. Of the various kinds of muscular tissues, the mylohyoid of the chameleon affords, probably, the most beautiful specimens. Dr. Beale's little favorite, the *Hyla arborea,* is not, I fancy, to be had in India; the *Hyla versicolor* may, however, be procured, but does not, according to my experience, afford such perfect specimens as the chame-

leon. Dr. Cameron, of Monghyr, kindly sent me down six of these curious creatures some time since. They have one after the other been killed and injected with Beale's blue solution, and the subsequent steps he describes in preparing tissues for examination under the higher powers of the microscope have been strictly attended to. (*Vide* Dr. Beale's book, 'How to Work with the Microscope,' third edition, p. 204.) The striped muscle of the Vertebrata is composed of one or more bundles of fibres, the whole being enclosed in connective tissue known as the sheath of the muscle. Numerous septa dip into the substance of the muscle from this sheath, so as to divide it into compartments of an irregular shape and size. Each of these is filled by a bundle of muscular fibres; the vessels and nerves ramify in the connective tissue of the septa, and are thus brought into immediate contact with the muscular fibres.

"If a bundle of muscular fibres is carefully examined under a low power, it will be found to consist of numerous fibres—the 'ultimate fibres of muscle.' Each ultimate fibre runs continuously from one end of the fibre to the other end, and is attached at either extremity to a fibrous structure, which usually assumes the form of a tendon; consequently the length of the ultimate fibre depends upon the length of the muscle, in the case of the sartorious being perhaps upwards of two feet, and in the stapedius a few lines in length. The diameter of the ultimate fibre varies according to the degree of development of its contractile element, as I shall presently explain. After a muscle has been kept in glycerine for a time we may easily isolate a bundle of these muscular fibres; the tissues being gently torn apart, a few ultimate fibres may be examined under a fiftieth of an inch glass.

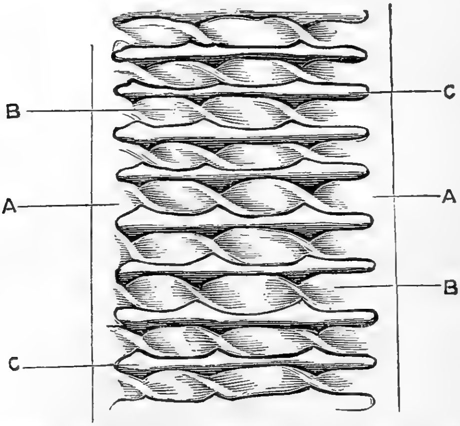
"Each ultimate muscular fibre will be found to be encased in a sheath of homogeneous tissue, called the sarcolemma, which is very apt to be thrown into perpendicular elevations and depressions, so that it is a common occurrence to see the ultimate fibre streaked by dark lines running in the direction of the length of the fibre, produced by the wrinkled surface of the sarcolemma. We may also notice elongated masses of germinal matter (coloured by the carmine we have used in making the preparation) scattered at pretty regular intervals throughout the sarcolemma. They are elongated in the direction of the length of the muscle, and are situated either above or below, or it may be on either side of the fibre in the substance of the sarcolemma itself. No doubt it is from these comparatively large masses of germinal matter that not only the sarcolemma, but the contractile tissue within it, is formed.

"With regard to the arrangements of the contents of the sarcolemma—that is, the essential and characteristic element of the striped muscle—I may compare it to a ladder of contractile tissue, the steps or horizontal bars of the ladder being, however, spiral bands, whereas its side pieces or perpendicular supports are flat bands running continuously from one end of the muscle to the other end. The horizontal bars connect these perpendicular ones, but, as above stated, are curled upon themselves like a spiral spring.

"As to the contractile tissue, it appears to me to be a homogeneous substance, its property being to contract in obedience to the nervous force set in motion either by a voluntary or a reflex stimulus. I believe the unstriped muscle affords us one of the least complicated examples of this contractile tissue to be found in the human subject, and I hold that the crystalline lens is equally muscle, and probably the most complex arrangement of contractile tissue to be met with. By this I mean that I have every reason to suppose the lens is capable of altering the curvature of its anterior surface independently of the ciliary muscle. I conceive the bands of which it is composed are constructed of contractile tissue, arranged in a peculiar manner, that they may fulfil a special purpose; but whatever form the contractile tissue may take, its properties are the same, the disposition of its elements being adapted to the mechanical purposes for which it is required. Each primitive fibre of muscle, therefore, is formed of two parallel bands of this contractile tissue, which run continuously from one end of the muscle to the other end, and these parallel bands are united by cross bands, which, however, are continuous with the side bands, so that, to carry our simile a step further, we must liken this arrangement, not to an ordinary ladder—each step or bar being a separate piece of wood—but suppose that the ladder has been carved out of a solid mass, the spaces between the bars having been scooped out of the plank from which we imagine the ladder to have been made. Each one of these cross-bars or steps is arranged as a spiral band. Enclose the whole of this in a layer of sarcolemma, and we have a primitive fibre; take a bundle of these and bind them round in connective tissue, and we have a bundle of muscular fibre; and of a collection of these, again, the bulk of the muscle is composed.

"The apparent object of this disposition of the contractile element in muscular fibre is to allow of the contraction of the muscle in length without any great augmentation in its bulk, the spaces between the horizontal bars allowing of this, and

at the same time the spiral arrangement of the cross bands allows of their elongation and contraction upon themselves



A A, Longitudinal bands; B B, Transverse spiral bands (both coloured by carmine); C C, Interspaces with dark border from shade cast by transverse bands.

without any stretching or pulling of the delicate substance of which they are composed.

"That there are open spaces between the horizontal bands appears to me certain from the appearance of the parts, and from the fact that the contractile tissue—and, in fact, all the structures of the body—may be stained with carmine, but these interspaces never show the slightest appearance of any colour, their hue in many specimens being exactly similar to that of the field of the microscope where no tissue intervenes between it and the lamp used for illuminating the object. What, then, is the meaning of the perpendicular and horizontal lines noticed in a specimen of muscular fibre when examined by a quarter or twelfth of an inch glass? The perpendicular lines may be produced either from the line of union of two primitive fibres or from the creasing of the sarcolemma or the fibrous case, which encloses a bundle of fibres; but an isolated primitive fibre, when examined under a high power, presents no appearance of longitudinal striation, provided its fibrous case and sarcolemma have been destroyed or rendered too transparent to be seen. The dark cross lines are caused by the shadows cast upon the open spaces, or by the approximation of two horizontal bars; under a high power these dark spaces may be resolved into two dark lines bordering the horizontal bands and an interspace of a very much lighter

colour, which is often, as I have above stated, of the same hue as the field of the microscope."

AMERICA.—**Silliman's Journal.**—"*On the Structure and Habits of Authophysa Mülleri (Bory), one of the Sedentary Monadiform Protozoa,*" by H. James-Clark, A.B., B.S.—We have before had to notice the careful studies of the author of this paper, who is devoting his energies to the most detailed study of single species of Infusoria. He observes, with perhaps a little more enthusiasm than accuracy, that the microscopes of the present day are to those of the past what Cuvier's scalpel was to those of his predecessors, and believes that a vast deal is yet to be learnt about the Infusoria by the use of the best glasses opticians can produce. This is possible; at present, however, we have not heard of a single discovery in biological science, acknowledged and confirmed as true, which may fairly be said to have been made by the use of a better glass than the $\frac{1}{4}$-inch objective of many years' standing. Mr. James-Clark describes the simple organization and habits of his Infusorian with great care, and really makes *use* of his high-power objectives and illuminating apparatus. We do not feel sure, however, that he would not have seen as much with a good "quarter," or at any rate an eighth. There are scores of persons in this country who have spent great sums of money over microscopes, and yet have never made a single observation worth recording; and the strangest thing is that these are the people (with rare exceptions) who possess the "sixteenths," "twentieths," and "fiftieths," made by our great microscope manufacturers. In Germany, where nearly all the good true work with the microscope is done, though the beauty of our English glasses is acknowledged, very few observers have even *seen* one of our expensive unused toys; and all is *done* by the cheap glasses of Oberhausen, Kelner, &c. Hence we have not, as a rule, much faith in persons who estimate the value of their observations by the figure of the magnifying power of their objectives. Mr. James-Clark, we believe, does not do this; he is a patient and acute observer, and is doing good service by his detailed studies of Protozoa.

NOTES AND CORRESPONDENCE.

I RECEIVED lately a letter from Count Franc Castracane, in which he desires me to forward to you the following remarks on the Woodward observations reported in the 'Quart. Journ. Mic. Sci.' for July, 1866.

"I quite agree," he says in the beginning, "with Mr. S. J. Woodward, that for microphotographical uses one may obtain nearly the same results with any undecomposed ray of light which has been transmitted through a solution of ammonio-sulphate of copper; and I am equally persuaded of the usefulness of microscopical objectives ready made to obtain the coincidence of the action with the visual forms.

The usefulness of a light modified by traversing a coloured medium has been pointed out on other occasions; and M. Bruster has lately suggested to illuminate the microscope with alcoholic light, saturated with chlorine of sodium. Such is the opinion, too, of Dr. Noiterrier (p. 180 and following of his very useful book 'La Photographie appliquée aux Recherches Microscopiques,' lately published in Paris by Baillière et fils.)

From the application of decomposed light to photography, I expected, indeed, a great advantage, which I did not obtain, as I tried to take any microscopical object illuminated with a violet ray resulting from the sun-light decomposed by an enormous prism, and sulphuretted carbon, which I had constructed on purpose. Nevertheless, I cannot but insist upon the usefulness of illumination with decomposed and vigorously microchromatic light, which may be obtained only with a good prism, seeing that the cobalt glass and the solution of ammonio-sulphate of copper admits with the violet some part of other rays, so that we can never obtain an absolute correction of the chromatic aberration, which it is known cannot be obtained by any combination of lenses, no matter how perfect they may be.

A proof amongst others of the efficacy of this illumination has been to resolve by it very easily the thirty groups of Nobert's test-lines, which Mr. Norman of Hull has been so kind as to lend to me, which experiment has been witnessed, amongst others, by the well-known director of the Astronomical Observatory of the Roman College, P. Angelo Secchi.

"A considerable augmentation of power in the microscope for the use of such an illumination would afford an easy way to decide the question which micrographers are still debating about the true form of the minute structural details of diatoms; first among them is the *Pleurosigma angulatum*, which earliest microscopists have deservedly chosen to test the power of their instruments. It is true that the material improvement which the microscope has obtained these last fifteen years has superseded this old test object. Still we may be allowed to observe that the assumed easiness in resolving the details of pleurosigma must be understood for the oblique, not for the direct and central illumination, especially when the preparation is made in Canada balsam.

"Whatever the direction of the light may be, and notwithstanding the great improvements which the microscopical objectives have received, the mode of explaining those very minute forms which adorn the surfaces of diatoms is still at variance. Schiff, Schultze, Schact, and Hartnach, amid the German—Wallich, Wenham, and Carpenter amongst the English, do not agree with themselves on this subject. They began noticing on pleurosigma some very minute striæ which present themselves in a particular direction under the influence of an oblique illumination; then, changing the course of the light, they observed another system of striæ. Then the opinion of some writers who, having noticed successively three different systems of striæ, two oblique and one direct, concluded they ought to be disposed in different planes. But more perfect objectives by connection and immersion, showing the three systems of striæ simultaneously, caused the first judgment to be rejected, and acknowledged that they were placed on the same level. The greatest difficulty they met with was to determine the shape of the areola limited by the different directions of the striæ. Some believed they were square, assuming that the transversal system of striæ was nothing but an illusion caused by aberration of spheriority. Schact considers them as hexagons, each side of them being the basis of a small equilateral triangle. Quekett, following Wenham, who succeeded in obtaining an image of *P. angulatum*, increased to 15,000, and another of *P. formosum* to 35,000 diameters, recognised and described the structure of these

pleurosigmata as a series of hexagonal spaces by which the surface of the valves is partitioned.

"Now, Mr. Woodward tells us that Wenham, abandoning his previous judgment, has acknowledged that the conformation of the markings is circular. Thus the hexagonal appearance in Wenham's photographs would be nothing, according to Jabez Hogg, but 'an exaggerated imperfection produced by an error of foix in his lenses.'

"These discordant views of the most celebrated micrographers encouraged me in trying to get a most possibly accurate idea on the subject, for the which purpose I examined most carefully the photographs of *P. angulatum* taken by myself and by others, too, under different degrees of power, giving my especial attention to the negatives on glass, which, it is well known, present a greater nicety of details than positives. And availing myself of the monochromatic illumination, which I always employ in testing the most difficult object, I felt convinced that the hexagonal form is the only true structural element of the surface of *P. angulatum*, seeing that by a direct observation with light decomposed, the striæ present themselves always bended (in zigzag) and never straight, and that but in three directions—one transverse, and two oblique.

"Besides all this, I must confess that I cannot understand how an object not perfectly in focus, or excessively magnified, may produce the illusion of a circular changed in any other angular form, whilst the contrary, it is obvious, succeeds whenever the vision of an object is less distinct, say for its being too far off, or for interposition of mistiness, or for any other cause.

"This is my simple manner of viewing the thing. However, I should always be glad if anybody would show me that I am mistaken. At any rate I wish they would try the monochromatic light, which I feel confident they will find useful to decide this as well as many other difficult points."

So far Count Castracane's letter on the subject. If there is in my rough translation any technical or other error, I hope you will correct it.—Yours very truly, PROFESSOR JOSEPH GAZLIARDI, Cardiff.

Microscope Lamp.—Mr. John Bockett sends us a photograph of his method of mounting and using a microscope lamp. A pillar upon a foot carries a glass lamp with a reflector behind it, and a condensing lens in front. The

reflector is about three and a half inches in diameter, and the bull's-eye condenser about two inches in diameter, and placed a little within the focus of the reflector. A shade is also provided. We have long used and recommended the addition of a silver reflector behind a lamp. It not only economises light, but for many purposes improves its quality, as objects may be illuminated almost entirely by the reflected light when the wick is turned low, and thus the glare of the direct flame is avoided. Mr. Bockett burns Belmontine, which gives a whiter light than paraffine.—*Intellectual Observer.*

A Mechanical Finger for the Microscope.—This is the name which Mr. H. L. Smith, of Kenyon College, U.S., has given to a very ingenious mechanical appliance, which will prove a boon to those microscopists who are engaged in the study of minute hard structures. Since the mere description of Mr. Smith's invention occupies nearly three pages of 'Sillimann's American Journal of Science' (No. 123), we must refer our readers to this source for details. The instrument seems likely to be extremely useful in delicate manipulation, since it can be made to move about in every direction over the stage, and thus to convey minute objects from one part of the field to another—and this, too, with the greatest precision, and in the most gradual manner.—*Lancet.*

Transmission of Slides by Post.—At the meeting of the Quekett Microscopical Club, held November 23rd, Mr. M. C. Cooke called attention to this subject, on account of the large proportion of broken slides which had come under his observation during the past two years. Sometimes he had received a dozen slides per week from as many different individuals, and insufficient packing was the rule, good packing the exception. Many persons only enveloped their slide in stiff paper, some in cardboard, and then enclosed them in their letters: such slides were invariably broken. Others sent slides in thin cardboard boxes, or wrapped in cotton-wool or wadding, and afterwards in cardboard: these were generally broken. Others again enclosed slides between thin strips of wood with small blocks, or corks at the ends or angles: these seldom travelled safely. The most successful mode of packing proved to be, either to enclose the slides (if more than one) in a small deal box; or, if single, to transmit them in the black paper cases sold by opticians. If these

cases are folded in a sheet of paper, in such a manner that about two inches of the paper extends beyond one end of the case, and the postage stamps are affixed to this free end, there will be no risk of damage from the obliterating stamp. It was suggested that additional security from local stamping would be given by pasting black paper round that portion of the package which contained the slide, and the address written on the free end of the paper. This would be the only white portion, on which consequently all stamping must be performed. A number of boxes and other contrivances for the transmission of slides, and which had passed through the ordeal of a journey, were exhibited; some of which, in their shattered contents, gave evidence of failure.

M. Eulenstein's Series of Diatomaceæ.—Those of our readers who are more especially interested in the study of Diatoms, will be pleased to learn that M. Th. Eulenstein, of Stutgard, who is well known as one of the most active investigators of the subject, has undertaken the publication of two distinct series of specimens of Diatomaceæ. One series will consist of AUTHENTIC and ORIGINAL specimens; and it is intended to facilitate the identification of the numerous species established by foreign authors. The uncertainty of nomenclature which has pervaded all the writings on this subject since the works of Ehrenberg and Kützing is entirely due to a want of accurate knowledge of these specimens, which M. Eulenstein has spared no pains to obtain for the present purpose.

Simultaneously with, but perfectly distinct from this series, M. Eulenstein intends also to publish another series, which will form, as it were, a STANDARD collection of the various types of the Diatomaceæ, and will contain typical representatives of nearly all the known genera, recent and fossil.

Each series, as we learn from the prospectus, will be issued in five parts, each part containing one hundred species. The first part of the first-mentioned series will consist chiefly of specimens selected from the herbarium of Professor Kützing, and will explain many critical species established by that author in his '*Bacillaria*' and 'Species Algarum.' The subsequent parts will contain original specimens illustrating the works of Ehrenberg, Heilberg, Grunnow, Rabenhorst, and others. Besides the numerous new and rare forms which will be found in this series, it will furnish systematists with a correct index to many species hitherto misunderstood, and

therefore constitute an indispensable part of a very scientific collection of Diatoms.

We understand that the specimens will be carefully prepared dry or in balsam, and mounted on thin slides of the usual dimensions used in this country ($3'' \times 1''$); and to each specimen will be affixed a label with the original name, locality, &c., whilst a separate list of synonyms, with critical notes, will be published with Part V.

It is hoped that the First Part of each series will appear in the early part of, and that the entire publication may be concluded within the year.

The number of collections belonging to the first mentioned series will necessarily be extremely limited; but it is to be hoped that the London Microscopic Society will be the depository of one of them. Those of the second series would appear to be almost indispensable for all real students of the Diatomaceæ, and we can only wish that M. Eulenstein may find that the pains and trouble he has bestowed upon the formation and dissemination of these collections may be properly appreciated.

We have been given to understand that besides Mr. Pritchard, Dr. L. Beale and Mr. Roper will be ready to afford any further information respecting M. Eulenstein's undertaking that may be required.

[Prospectuses may be obtained, and the Collections ordered, at Messrs. R. and J. Beck's, 31, Cornhill, E.C.]

PROCEEDINGS OF SOCIETIES.

ROYAL MICROSCOPICAL SOCIETY OF LONDON.

June 13th, 1866.

JAMES GLAISHER, Esq., President, F.R.S., in the chair.

The PRESIDENT announced to the Society with deep regret the recent and almost sudden death of Dr. Greville, of whose labours in connection with microscopical science he spoke in high terms.

The following paper was read "On the Surface Fauna of Mid-Ocean," by Major Saul Owen, Member of the Royal Microscopical Society, and Associate of King's College, London. (See 'Trans.,' p. 115, vol. xiv.)

Mr. HENRY LEE, referring to a recent discussion on the subject of Major Owen's paper before the Linnean Society, said—The great question that arose on that occasion was with reference to certain examples found in surface skimmings, which had hitherto been supposed to exist only at the bottom.

Mr. JEFFERIES rose to ask whether these were found beyond the influence of the Gulf Stream, and thought they might be *dead* specimens floating on the surface. Major Owen had mentioned in his paper that he only found them at night, never by day. Now, these must have been in possession of full vital powers, because they were sensible to light, and this fact proved the possibility that the same examples existed at a depth of two or three miles as at the surface of very deep oceans. Major Owen has mentioned that in some places he found specimens to be very abundant, and in others very scarce. It occurs to me that another observer skimming the surface in the same places might meet with contrary results, as conditions of the air or sea may have existed which caused the objects to sink down during the day and to rise at night.

Mr. BROWNING thought Major Owen's suggestion as to obtaining the spectra of various animals might be advantageously worked out. This would, however, require a spectroscope to be made for the special purpose, as the ordinary spectroscope would

be almost certain not to yield any spectra at all. Mr. Browning concluded by offering to place a number of prisms in his possession at the service of any member desirous of going extensively into the subject.

Dr. Mann (of Natal), referring to Major Owen's suggestion as to the application of the spectroscope to the light from living organisms, said—The north-eastern side of the Cape (from which I come) certainly affords a fine field for research into this particular subject. I have there passed over places where I have seen some dozens of creatures showing greater light than the fire-fly. We have in south-eastern Africa curious creatures, which crawl on the ground, and show a prodigious amount of light. They are not, however, glow-worms, but centipedes. I think we have here a fine field for the application of the spectroscope. I have, gentlemen, been away from England for some years. When I went away the spectroscope was unknown; and now I come home literally to find myself at sea, and therefore you will not be surprised that, among other matters, I have not taken the subject up. I think, however, that it affords a fine field for research, which I will do my best to qualify myself to explore. The effect obtained from the light on the sea is incredible to those who have not witnessed the blaze in some of the southern latitudes. In Natal, which is about twenty-nine and a half degrees south, we have little phosphorescence, and towards the Cape we have less; but in the lower latitudes, both east and west of the Cape, the sea is often one blaze of light.

The Rev. J. B. Reade referred to the researches of Captain Toynbee, who had made several voyages to India, and made a constant practice of dredging in a manner similar to that which had been described, and with great success; and some of the *Rotalia* he thought approximated more to the form of the nautilus than any of the drawings which had been produced.

Major Owen.—I do not think any of the *Rotalia* are found on the surface.

The Rev. J. B. Reade.—It is not quite that form. Mr. Reade concluded by mentioning that he had some magnificent specimens which were being mounted under the polarized light.

Mr. F. H. Wenham asked Major Owen if he could explain how the creatures changed their specific gravity so as to rise to the surface and sink again, or whether it resulted from the varying temperature of the water.

Major Owen said he had been unable to trace this out, but suggested the possibility of their being able to expand some small vesicle to a sufficient degree to enable them to rise. He differed from Dr. Wallich, who said that when the creatures were once at the bottom of the ocean they could not rise again. If they were found at the bottom and also on the surface, they must have some means of rising. They must have some means of rising, because they did rise at certain times, and he had ascertained that they were alive when they did so.

Dr. Mann thought that the rising and sinking could not be caused by the temperature, as that increased as the line was approached at so even a rate.

The President, in closing the discussion, proposed a vote of thanks to Major Owen for his paper (which was unanimously awarded), and expressed his satisfaction that they would have the benefit of Dr. Mann's further investigations into the subject on his return to Natal, with the additional advantage he would now possess by having the aid of the spectroscope in so doing.

Major Owen, in responding, said that what he had brought forward must be taken as facts only, as he drew no conclusions from them. Adverting to the effect of polarized light upon the specimens, the Major added that he had one prepared in Canada balsam which retained its colour, which they very rarely did. The smallest chambers were a bright red, and the larger chambers of a reddish-brown.

The President reported that the application for the Charter was proceeding satisfactorily, and with every prospect of success.

The meeting then adjourned to Wednesday, 10th October next.

October 10*th*, 1866.

James Glaisher, Esq., F.R.S., President, in the chair.

The minutes of the preceding meeting were read and confirmed.

Various presents were announced, and the thanks of the Society returned to their respective donors.

Certificates of thirteen candidates for admission into the Society were read and ordered to be suspended in the usual manner.

R. Braithwaite, M.D., F.L.S., &c., 59, Vauxhall Walk, was balloted for and duly elected a Fellow of the Society.

The President announced the death of Richard Beck, Esq. He also produced and read the Charter of Incorporation, and announced that the next meeting would be a special general one, to consider and pass the by-laws of the Society as now constituted.

The cordial thanks of the meeting were returned to the President, James Glaisher, Esq., for his exertions on behalf of the Society in obtaining the Charter.

T. W. Burr, Esq., was presented with a silver inkstand as an acknowledgment of his valuable and gratuitous services in obtaining the Charter of Incorporation.

H. J. Slack, Esq., F.G.S., Hon. Sec. R.M.S., read a paper "On a Diaphragm Eye-piece for the Microscope." ('Trans.,' p. 1.)

At the close of a short discussion on this paper the President remarked that he had used this eye-piece, and had been able to take in the whole field; and that on limiting the field in the way described he found that he saw much better than when the eye was drowned with the light of the whole field. This apparatus also had the advantage of enabling them to isolate a square or a

rhomboidal figure in any part of the field, and it was, of course, much better to have just enough of light, and not too much. It was curious, too, to see how the markings of objects changed by varying the degree of light in the field.

Mr. Jabez Hogg expressed a favorable opinion of the diaphragm eye-piece.

The President said that at the last meeting he had expressed a hope that the recess would be productive of successful microscopical investigations, and he now hoped that the Society would have the benefit of its members' labours in the session just commencing. Its officers had not been idle, and he had great pleasure in reporting that the result of constant application on their part to the object they had in view for some time past was that he now held in his hand the Charter of Incorporation of the Society. But, while congratulating the Society in this respect, he had to lament that the present was the most painful of their meetings in which he had taken part, inasmuch as in the interval to which he had just alluded they had lost one of their most dear and honoured members. Until now he had never missed the face of Richard Beck from their gatherings, and he could not express the pain and sorrow he had experienced on hearing of his illness and death; and on the occasion of the funeral he had felt constrained to express, on the part of the members, as well as for himself, the sincere respect which he was sure they all felt for the memory of one who had laboured so earnestly for the benefit of their science and of their Society. Before reading the Charter he ought to tell the meeting that at the moment when the subject was first spoken of, Mr. Burr, in the most handsome way, offered his professional services gratuitously. He had now to read the Charter. ('Trans.,' p. 7.)

At the conclusion of the reading of the document, of which the above is a copy, the original Charter, under the Great Seal of England, was passed round the room and examined by the members.

The President, continuing, remarked that since the grant of the Charter the Council, as the Secretary had stated, had taken steps for securing in addition the distinctive title of a Royal Society, and he hoped to be able to make a satisfactory communication to the members as to this at their next meeting.

Mr. Lobb, referring to the debt which the Society owed to their President for his great exertions in respect to the Charter just read, said that several of the members were desirous of securing to the Society the advantages of Mr. Glaisher's labours as President during the ensuing year; but it was found that Mr. Glaisher could not be re-elected without one of their by-laws being suspended; he now rose, therefore, to give notice that at the next meeting the by-laws be suspended in order that, if the members should think fit, Mr. Glaisher should be re-elected. He felt quite sure that at the proper time the members would be unanimous in the expression of their opinion that hitherto they had had no Presi-

dent who had exerted himself so much or accomplished such good things for the Society. (Loud cheers.)

The President said it had been his wish to retire in the ordinary course at the end of his present year of office; but at the urgent solicitation of the Council he had consented to assume the responsibilities of office during another year, if it should please the members to confer the honour upon him. When he had first accepted the post he had to remark that his pursuits gave him but little claim to a reputation as a microscopist, as the result of many years' close occupation with the telescope had so unsteadied his eye that he found himself unable to apply himself to microscopical studies to the extent he wished. He hoped the members would therefore understand his silence sometimes as President when important papers were read at their meetings, as he felt it to be his duty to hold his tongue in cases where, by reason of his lack of knowledge and experience, he could not speak with so much authority as would be attached to the utterances of many of the gentlemen around him. He could, however, give his hearty assurance that in any other way he would spare no effort in placing the Society in the important position which its objects deserved, and he hoped that the next few months would see the Society occupying, if possible, a still higher rank than that which had been already attained.

The President said he rose to perform a most pleasing duty. When, being in earnest and influenced by a strong desire to attain success, they met with valuable co-operation, heartily given, regardless of the time or trouble it cost, the desire was very natural that they should offer every expression of their gratitude to those who rendered them such help. He felt that they had had such help from Mr. Burr, who, when the question of a Royal Charter was at first suggested, had come forward in the handsomest manner and given the Society the benefit of his professional asssistance without fee or reward, and, from the first moment of his putting his hand to the work until it was crowned with success, he had not for an instant swerved from his purpose. The Council of the Society, knowing, as they did, that the fact of their having obtained their Charter so soon was mainly due to the indefatigable labours of Mr. Burr, had determined to offer that gentleman some slight memento of their gratitude; and he (the President) felt that in this they were only expressing the wish of the members as a body. They had accordingly obtained the silver inkstand now on the table, bearing this inscription:

> "Presented to T. W. Burr, Esq., F.R.A.S., F.C.S., F.M.S., &c., by the Council and Fellows of the Microscopical Society of London, in acknowledgment of his professional services in obtaining the Royal Charter of Incorporation. 10th October, 1866."

The President, addressing Mr. Burr, said—I have only now

to ask you, sir, to accept this simple token of the esteem in which you are held by the Council and Fellows of this Society, and of their appreciation of the valuable assistance you have rendered so kindly and continuously. We hope that you will often call back the pleasure with which we have co-operated together, and that your children after you may preserve this little token, not alone for its intrinsic value, but as a record of the feeling of which we offer it to you as some expression.

Mr. Burr, in responding, said he had never supposed that the services which he had rendered were to be rewarded by so substantial and elegant a testimonial. He had only been influenced by the same earnest desire to attain the Charter which animated the President and every member of the Council; but as a professional man his labours appeared more prominent than those of other gentlemen. He could truly say that he should have felt amply rewarded for his part of the work by a simple vote of thanks. The merits of the Society were quite sufficient in themselves, when properly represented, to command the grant of the Charter and the only thing he could take any credit for was the personal attention he had given to the matter. He sincerely congratulated the Society upon the possession of the Charter, and trusted that it would afford the members a better status in the scientific world, and give a renewed impetus to their researches. Personally, he was deeply indebted to them for the very handsome present, and he trusted that it would continue to be regarded by his children with the same gratification and pleasure as that with which he received it.

The President remarked that, as the next meeting was to be special, it would afford a favorable opportunity of discussing certain revisions in the by-laws which were necessary in order to bring them into accordance with the Charter. For that reason only, he hoped that at the next meeting a great number of the members would endeavour to be present; the Council were also taking steps to obtain the signatures of every Fellow of the Society, in a book provided for that purpose. The absence of their old and well-remembered friend, Mr. Beck, should urge upon the members the importance of this duty.

In reply to questions, the President said that the attention of the Council had already been directed to the absence from the Journal of the Society of a report of the meeting of the

The President urged upon the members the desirability of communicating to the Assistant-Secretary their full names, titles and addresses, together with the initials of learned societies, &c. In appealing for the contribution of papers to be read at the meetings, he referred to the necessity of their being sent in a few weeks before the time they were intended to be read. The advantages to the writers would be fully equal to those thus conferred upon the Society. Announcement could also be made from meeting to meeting that particular papers were to be read, and this would doubtless have great effect in inducing the attend-

ance of gentlemen acquainted with and interested in the subjects of the papers.

Mr. SUFFOLK, in compliance with a request from the chair, referred to some tin cells which he had described at a previous meeting of the Society. His difficulty had hitherto been in obtaining more than one thickness of metal; but Mr. Collins, the optician, of No. 77, Great Tichfield Street, had taken an interest in the matter, and had had several different thicknesses of the metal rolled. The same gentleman had set up a punching machine, and the plates were now made without the conical burr, as at first. They were made of pure metal, and could be had of Mr. Collins at a very low price.

Mr. JABEZ HOGG remarked that he had used these plates for some time with great pleasure and satisfaction. He thought they were very useful in the formation of cells, as they adhered very well to marine glue, and they thus got rid of the nuisance of glass cutting. Of course, these cells would not supersede glass in using metallic solutions, such as the bichloride of gold.

Mr. SUFFOLK said he had used such solutions as chloride of calcium, chloride of sodium, glycerine mixtures, and camphor water, for two or three years without any change in the cells.

The thanks of the meeting were voted to Mr. Suffolk for bringing the subject again before the Society.

The PRESIDENT then appealed to the members for duplicates of objects; and Mr. LOBB, in supporting this request, remarked that, as the keeper of the cabinet, he regretted to say that there had never been a year in which so few slides had been contributed to the Society.

The meeting then adjourned till the 9th of November.

Nov. 14th, 1866.

R. J. FARRANTS, Esq., in the chair.

The minutes of the preceding meeting were read and confirmed.

Various presents were announced, and the thanks of the meeting voted to their respective donors.

Certificates of nine candidates for admission into the Society were read and ordered to be suspended in the usual manner.

Frederick Wm. Gay, Esq., 113, High Holborn; James Wight, Esq., General Post Office; John Salmon, Esq., Loughton; John Hirst, junr., Esq., Dobcross, Manchester; Andrew Lows, Esq., Lowther Street, Carlisle; Frederick George Fitch, Esq., 40, Highbury New Park; Montagu Burnett, Esq., Alton; Stephen Helme Esq , 23, Lansdown Road, Dalston; James John Smith, Esq., 56, Tollington Road; Frederick Henry Leaf, Esq., Burlington Lodge, Norwood; H. Turberville, Esq., Pilton, Barnstaple; Dr. A.

C. Macrae, 41, Warrior Square, St. Leonards'; were balloted for and duly elected Fellows of the Society.

Mr. Thwaites, Bishop Auckland, was balloted for and re-elected Fellow of the Society.

Dr. Braithwaite, and Andrew Lows, Esq., were duly admitted Fellows of the Society.

The following letter from Mr. Secretary Walpole was read:

"WHITEHALL;
"1*st. Nov.*, 1866.

"SIR,

"I am directed by Mr. Secretary Walpole to inform you, with reference to your letter of the 23rd of September, that he has had the honour to submit to the Queen your request that the Microscopical Society may be permitted to assume the title of 'Royal,' and that Her Majesty has been graciously pleased to accede to your request, and to command that the Society shall be styled the 'Royal Microscopical Society.'

"I am, Sir,
"Your obedient servant,
"BELMORE.

"JAMES GLAISHER, Esq.,
"*President of the Royal Microscopical Society.*"

Mr. Wenham read a paper "On a New Form of Prism."

Mr. Richards orally described a tube for prolonging the body of the microscope, to enable it to view objects on the table.

Resolved unanimously—"That the thanks of the Society be returned to F. C. S. Roper, Esq., for his valuable services as one of the Honorary Secretaries of the Society."

It was announced that Mr. H. Davies would read a paper at the next meeting "On two New Species of a Tube-bearing Rotifer."

The Society then adjourned to a Special General Meeting.

It was resolved unanimously—"That By-Law No. 27 be suspended, *pro hac vice*, to enable Mr. Glashier to be re-elected President of the Society for the year ensuing."

The reading of the revised By-Laws was then commenced.

Proposed by Mr. HOGG, seconded by Mr. INCE, and carried unanimously—"That the Entrance Fee be in future Two Guineas instead of One Guinea, as heretofore." This, however, is not to affect persons elected or proposed on this evening.

The remaining By-Laws were then read and passed unanimously.

December 12*th*, 1866.

R. J. FARRANTS, Esq., in the chair.

The minutes of preceding meetings read and confirmed.

Six presents were announced, and the thanks of the Society returned to the donors.

Certificates in favour of seven candidates for election into the Society were read, and ordered to be suspended in the usual manner.

Dr. Braidwood, Carlisle; Thos. Croak, Esq., Thames Ditton; C. W. Calthorp, Esq., Alford; Thos. Curties, Esq., 244, High Holborn; Chas. Davis, Esq., 14, Wimpole Street; Rev. J. H. Ellis, Thame, Oxon; Dr. Gray, 23, Princes Street, Cavendish Square; R. T. Lewis, Esq., Lowndes Terrace, Knightsbridge; Wm. Maguire, Esq., 35, Queen Square; and W. C. Pickersgill, Esq., Bexley, were balloted for, and duly elected Fellows of the Society.

The Secretary communicated to the Society the following letter from Mr. Carruthers, of the British Museum:

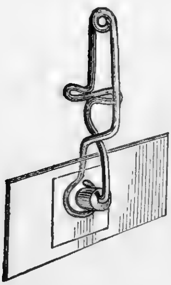
"It would be well that the Fellows of the Microscopical Society should know that the type specimens of all Greville's Diatomaceæ, figured in their 'Transactions,' are now deposited here, and that the collection includes not only Greville's own slides, but also those prepared by the late Professor Gregory, some of which were described and figured also in the 'Transactions' of the Microscopical Society. These, added to the type-collection of Professor W. Smith, who monographed the British species, make our collections here invaluable as an authoritative series of the British Diatomaceæ."

The following papers were read:—"On a new Condenser," by Rev. J. B. Reade; "On two new Species of Tube-bearing Rotifers," by H. Davis, Esq.

A series of photographs from Major Woodward, of America, was exhibited by Mr. How.

The thanks of the meeting were voted to these gentlemen for the same.

"Wire-Spring Clip for Microscopic Mounting."—Mr. Jabez Hogg exhibited a wire-spring clip for holding down the covering-glass when preparing microscopic objects. It is shown in the accompanying figure in use. A clip somewhat similar was devised by Dr. Maddox; this, however, is a decided improvement, and is made by bending an elastic brass wire, so that it will open and shut like the common letter-slip. The cover is pressed down by the small cork, or, what is better, a thick pledget of leather (seen in the figure), and held in its place while cement is applied or allowed to dry, or Canada balsam allowed to insinuate itself by capillary attraction. Mr. Jabez Hogg stated that he had found them extremely useful, and that Mr. Baker is selling them at a very small price per dozen.



SUBSCRIBERS TO THE CHARTER FUND OF THE ROYAL MICROSCOPICAL SOCIETY.

	£	s.	d.
Alexander, Gen. J., R.A., C.B.	1	1	0
Allen, C. J. H., F.L.S., *Treasurer*	50	0	0
Baker, C.	2	2	0
Beale, L. S., M.B., F.R.S.	2	2	0
Bell, Thomas, F.R.S.	2	2	0
Bennet, J. L.	2	2	0
Berney, J.	1	1	0
Bevington, Geoffrey	1	0	0
Bezant, W. T.	1	1	0
Bidlake, J.P., B.A., F.C.S.	1	1	0
Bigg, H. Heather	1	1	0
Billing, A., M.D., M.A., F.R.S.	1	1	0
Bishop, George, F.R.A.S.	1	1	0
Black, H.	1	1	0
Bland, F. L.	1	1	0
Blanshard, H., F.Z.S.	1	1	0
Blenkins, G. E.	1	1	0
Bossey, F., M.D.	1	1	0
Bowerbank, J. S., LL.D., F.R.S.	5	5	0
Bradley, C. L., F.L.S.	1	1	0
Brand, T.	1	1	0
Brooke, C., M.A., F.R.S.	2	2	0
Browne, Rev. T. H.	2	2	0
Bunting, F.	1	1	0
Burton, J. R.	1	1	0
Busk, George, F.R.S.	1	1	0
Bywater, Wm. M.	1	1	0
Carpenter, W. B., M.D., F.R.S.	2	2	0
Ceeley, R.	1	1	0
Chamberlain, T.	1	1	0
Cubitt, C.	1	1	0
Cundell, G. S.	1	1	0
Davis, G.	1	1	0
Davis, R., F.L.S.	1	1	0
Davison, T.	1	1	0
Dayman, C. O., M.A., F.R.A.S.	2	2	0
Deane, Henry, F.L.S.	1	1	0
De la Rue, Warren, F.R.S.	5	0	0
Delferier, W.	1	1	0
Denman, J. L.	2	2	0
Dyster, F.D., M.D., F.L.S.	5	0	0
Ellis, Septimus	0	10	6
Farrants, R. J.	1	1	0
Farre, Arthur, M.D. Cantab., F.R.S.	5	5	0
Finzil, C. W., F.R.H.S.	1	1	0
Fitch, F.	1	1	0
Fox, C. J.	1	1	0
Freestone, W. L.	1	1	0
Fryer, G. H.	1	1	0
Garnham, J.	1	1	0
George, E.	1	1	0
Gilbertson, C.	1	1	0
Gillett, W. S., M.A., F.R.A.S.	1	1	0
Glaisher, Jas., F.R.S., *President*	5	5	0
Gray, P., F.R.A.S.	1	0	0
Guyon, G.	1	1	0
Hall, W. H.	1	1	0
Handford, G. C.	5	5	0
Hardy, M. C.	1	1	0
Hennell, Colonel Samuel	2	0	0
Hepburn, J. G.	1	1	0
Heseltine, J.	1	1	0
Hilton, Jas.	2	2	0
Hogg, Jabez, F.L.S.	1	1	0
Hopgood, Jas.	2	2	0
Hudson, Robt., F.R.S.	1	1	0
Huxley, T. H., F.R.S.	1	1	0
Ince, W. H., F.L.S.	5	5	0
Jones, P., F.L.S.	1	1	0
Ladd, W.	1	1	0
Lankester, E., M.D., F.R.S.	2	2	0
Lankester, E. Ray	1	1	0
Lealand, P. H.	1	1	0
Lee, Henry, F.G.S.	2	2	0
Lister, J. J., F.R.S.	5	5	0
Lobb, E. G.	2	2	0
Lowe, Capt. W.D., F.G.S.	1	1	0
Lubbock, Sir John, Bart., F.R.S.	2	2	0
Makins, G. H.	1	1	0
Manchester, The Duke of, F.R.H.S.	1	1	0
Manners, Admiral, R. H., F.R.A.S.	1	1	0
Mason, S., F.R.A.S.	1	1	0
Meade, The Honble. R. H.	1	1	0
Mestayer, R.	2	2	0
Millar, John, F.L.S.	2	2	0

	£	s.	d.
Moore, Joseph	2	2	0
Morrieson, Colonel Robt.	2	2	0
Mummery, J. R., F.L.S.	2	2	0
Murchison, Sir Roderick J., Bart., K.C.B., F.R.S.	5	5	0
Murray, Jas.	1	1	0
Murray, J. T.	1	1	0
Noble, J. G., F.R.H.S.	1	1	0
Pattison, J., M.D.	1	1	0
Perigal, H., jun., F.R.A.S.	1	1	0
Pigott, G. W. R., M.A., M.D. Cantab.	1	1	0
Prothero, T., F.S.A.	1	1	0
Reade, The Rev. J. B., F.R.S.	1	1	0
Rideout, W. J.	1	1	0
Rikatcheff, Michl., Lieut. I.R.N.	1	0	0
Roberts, J. H.	1	1	0
Robinson, C., M.D.	1	1	0
Robinson, Jas.	1	0	0
Roper, F. C. S., F.L.S.	5	5	0
Ross, T.	2	2	0
Rothery, H. C., M.A., F.L.S.	2	2	0
Rutt, H.	1	1	0
Sanders, Alfred, F.L.S.	1	1	0
Shadbolt, George	1	1	0
Sharp, G. Y.	1	1	0
Shrapnel, F. K.	1	1	0
Shuter, J. L., F.R.A.S.	1	1	0
Silver, H. A.	1	1	0
Slack, H. I., F.G.S.	2	2	0
Smith, Basil Woodd, F.R.A.S.	5	5	0
Smith, Jas., F.L.S.	1	1	0
Spicer, Rev. W. W.	1	1	0
Stevens, H., M.D., F.Z.S.	1	1	0
Streatfeild, J. F.	1	1	0
Suffolk, W. T.	1	1	0
Symonds, F.	1	1	0
Terry, W., F.Z.S.	1	1	0
Thompson, F.	1	1	0
Tingle, Thos., F.L.S.	1	1	0
Tomkins, J. N., F.Z.S.	2	2	0
Townley, Jas., M.D., F.L.S.	1	1	0
Tulk, J. A., F.G.S.	2	2	0
Tupholme, J. T.	1	1	0
Tyer, E., F.R.H.S.	1	1	0
Tyler, Charles, F.L.S.	5	5	0
Tyler, G.	1	1	0
Tyler, Rev. W.	1	1	0
Vanner, W.	1	1	0
Vinen, E. Hart, M.D., F.L.S.	1	1	0
Ward, N. B., F.R.S.	1	1	0
Waterhouse, John, F.R.S.	1	1	0
Wenham, F. H.	1	1	0
Westley, W.	2	2	0
Westwood, W. H.	1	1	0
Whitbread, S. C., F.R.S.	5	0	0
White, Alfred, F.L.S.	1	1	0
White, C. F.	1	1	0
Whitling, H. F.	1	1	0
Wiltshire, Rev. T., F.L.S.	1	1	0
Woodward, Chas., F.R.S.	5	5	0
Woodward, Chas., F.R.S., *additional*	5	0	0
Wright, W.	1	1	0

LINNEAN SOCIETY, *December* 6*th*, 1866.

AT the meeting of the Linnean Society held on the 6th of December, Sir John Lubbock gave an account of a new genus, probably constituting the type of a new order in the class *Myriapoda*. This addition to the British Fauna is, in many respects, one of the most interesting that has been received since that of *Poynema natans*, described by the same acute observer a short time since,* which so much startled Entomologists at the time of its announcement. The new genus is termed *Pauropus*, indicative of the comparative paucity of its legs in the class to which it belongs; and the particular species upon which the generic characters are based is named *Pauropus Huxleyi*, but the author stated that he had also met with a second species, apparently less

* 'Linn. Trans.,' xxiv, 1863, p. 135.

common, for which he has proposed the name of *P. pedunculatus.*

The generic characters are:—"Body composed of ten segments, including the head, convex with scattered hairs. Nine pairs of legs. Antennæ five-jointed, bifid at the extremity; and having three, long, jointed appendages."

Pauropus Huxleyi, n. sp.

The body consists of ten segments, the first two of which comprise the head. In form it is slightly tapering in front, each segment being somewhat narrower as well as shorter than that which follows it. The two caudal segments somewhat smaller than the penultimate. The third segment and that immediately following the head bears one pair of feet, while the fourth, fifth, sixth, and seventh segments have each two pairs. But these segments may be regarded as double. The posterior legs are the longest. Each segment from the third to the seventh inclusive has on the side margins of the back a pair of strong bristles. The pair attached to the third segment point forwards, those of the fourth are at right angles to the body, and the posterior ones point backwards. Besides these long bristles, the body bears on each of the larger segments two transverse rows of short stiff club-shaped hairs, which are most numerous on the head. The body is quite white and colourless, except the head and last two segments, which have a slight tinge of yellow.

Length $\frac{1}{25}$th of an inch.

Hab.—Among dead leaves and other decaying vegetable matter, in hot-beds.

Sir John Lubbock stated that this little active creature was found by him during the course of the last autumn, and exhibited to the Entomological Society at their first meeting. It occurs in considerable numbers among dead leaves and in other accumulations of decaying organic substances. Though not exactly sociable in its habits, nevertheless the species exhibits none of that extreme ferocity which characterises the *Chilopoda;* it seems to be very abundant in his garden at High Elms, and it is, therefore, the more surprising that it should have been so long overlooked. This, however, he suggests, may arise from its minute size, small number of legs and general appearance, which would naturally at first sight cause the creature to be regarded as a larval or immature form. That it is not such, however, has been satisfactorily determined for reasons which were fully stated.

Amongst the most remarkable characters of *Pauropus* are—

1. The Antennæ, which are only five-jointed and bifid at the extremity. The four basal segments are simple and short, but increasing slightly in length from the base. The fourth segment bears at its extremity two branches, each consisting of a single segment. One is slightly longer than the fourth segment, and rather thinner. The other is nearly twice as long and half as broad. The first bears two very curious appendages consisting of an immense number of rings, the first and last of which are larger

than the others. The second branch terminates in a similar but longer appendage. These curious appendages remind one very much of the toy-snakes, which consist of a number of saucer-like segments united at the middle. The fourth segment of the antennæ also bears hairs at its extremity, two on one side and one on the other; the latter much the shorter. Each of the three basal segments supports a pair of rod-like almost clubbed hairs, which are divided by a number of lines almost like the curious ringed appendages. These ringed hairs are no doubt connected with sensation. Between the two appendages of the branch is a small rounded body which is sessile in *P. Huxleyi,* and pedunculate in *P. pedunculatus,* so named from that circumstance.

The structure of the mouth appears not exactly to agree with that of either the chilopods or diplopods (*Chilognatha.*) The mandibles are distinct, somewhat elongated, and have several teeth at the extremity. Besides these the other parts of the mouth have not been distinctly made out. Two pointed, unarmed, jointed appendages, may be supposed to correspond with the first pair of legs of *Lithobius*, or they may represent labial palpi; but, at present. their homology is obscure.

The different views of naturalists respecting the position or value of the Myriapoda are then stated, and the author gives his reasons for adhering to the opinion of those who regard them as forming a distinct Class "separated from the other classes of Annulosa by characters of at least equal importance with those by which those classes are distinguished from one another."

Adverting to the remarkable fact that all Myriapods have at first three pairs of legs, and three pairs only; and that the same is the case among the Acarina, and that it might at first be supposed that these three pairs represented the six legs of insects, the author states that there is nevertheless a general agreement of opinion that these three pairs do not homologically represent those of true insects. At the same time the *consensus* is not so general as to what they do really represent.

Nevertheless, the fact that centipedes commence life with no more legs than other Arthropods, and only acquire by degrees their most obvious characteristic, is very important; and as what is true of all the species may be reasonably concluded to have been true of the whole group, we might have inferred *à priori* that, although in the words of Newport, "there are never fewer than twelve segments and eleven pairs of legs in any genus of Myriapoda," still there must have been at one time species possessing a smaller number of appendages. The genus *Pauropus* is, in fact, such a species, and possesses only nine pairs of legs. It tends, therefore, to a considerable extent to fill up the gap.

With respect to the relations of *Pauropus* to the already known groups of Myriapods, it must be admitted that in some important characteristics *Pauropus* closely resembles *Scutiger.* But the structure of the mandibles and of the legs shows that these resemblances are only analogical and do not indicate any close affinity. In fact, the Scutigeridæ are highly developed Chilopoda, which *Pauropus* is not. If, however, the existing Myriapods are descended from ancestors having a smaller number of segments

and of legs, then we must expect to find that the links by which we shall eventually be able to connect not only the two great orders of centipedes together, but also the Myriapods, as a whole with the other classes of articulata, will possess a small number of appendages. The Scutigeridæ do not constitute such a group; but *Pauropus* apparently does.

The differences between *Pauropus* and the known Chilopods and Diplopods are then indicated.

From the former the new genus differs chiefly in the antennæ having only five segments; in the absence of the powerful second pair of foot-jaws, and in the circumstance that the generative openings are probably situated in the anterior part of the body.

From the Diplopod or Chilognathous group it differs in the pairs of legs being all equidistant and placed in distinct pairs. Moreover in all Diplopods the first three pairs of legs are distinguished from the rest by being attached to a single apparent segment, whereas in *Pauropus* this is only the case with the first pair. Again, in all Diplopods the legs are equal in size, or if there be any difference the posterior pairs are rather smaller than the others, whilst in *Pauropus* they are decidedly longer. In all Diplopods, again, the feet terminate in simple claws, which is not the case in *Pauropus*. The mouth-parts, though very different from those of the Chilopods, appear to resemble those of that group in a rudimentary condition rather than those of the Diplopods.

Lastly, the eyes and antennæ are very unlike those of any Diplopod, or in fact of all known Myriapods, the latter reminding us strongly of the types presented in the antennæ of certain crustacea.

The above notice will suffice to show that *Pauropus* is a most interesting subject of inquiry, and as it is one from its minute size and delicate structure eminently requiring skilful microscopical investigation, we have thought the space here devoted to it well bestowed.

Dublin Microscopical Club.

July 19th, 1866.

Mr. W. Archer took occasion to exhibit for the first time to the Club, and, as definitely identified indeed, he thought, new to Britain, *Œdogonium rostellatum* (Pringsh.). This is one of several monœcious species; but it is also characterised by the oogonium not opening by a pore, or aperture formed in its wall, for the admission of the spermatozoids, as is usual in this genus, and the only mode in Bulbochæte, but by a circumscissile dehiscence. From the cleft so produced an inner membrane projects, which seems to be itself perforate. These specimens occurred in considerable

quantity in a pond close to Enniskerry. He was able likewise to exhibit another species, so far as he was aware hitherto unrecorded in this country, namely, *Œdogonium acrosporum* (de Bary). This occurred exceedingly sparingly; indeed, he had seen only two or three examples of the fructification. This is of a different type from the preceding, being a gynandrosporous species; and the specimen well showed the dwarf male plant and the oogonium. Mr. Archer also showed in fruit *Œdogonium echinospermum*, as well as the same Œdogonium he showed at the meeting of the Club in July, 1865 (the minutes of which for details please see), and as to which he felt somewhat in doubt as to its being *Œdogonium apophysatum* (Pringsheim) or *Œdog. setigerum* (Vaupell). But be it as it may, he would here mention that he had taken this latter plant, quite identical in all its characters, for three successive years from the same pool, also from one or two adjacent ones, as well as on the occasion of a visit to the Vartry bed; the exact spot there he could not recollect, but at all events it is one which will be completely submerged when the long-delayed Vartry water-works are completed. These three gynandrosporous forms (the first new to this country) were in fruit, showing the oogonia and dwarf male plants (the latter of the structure called "outer" by Pringsheim) very beautifully.

Mr. Archer then drew attention to a form of Saprolegniaceous plant which seemed without doubt to be undescribed.

When at first glance he saw this form, he momentarily thought he had encountered a true and distinct *gynandrosporous* type of fructification in the Saprolegnieæ, the existence of which, *à priori*, one would be disposed to believe likely, and which Pringsheim's observations, mentioned in his magnificent memoir ('Jahrbücher für wissenschaftliche Botanik,' Band ii, p. 213; 'Nachträge zur Morphologie der Saprolegnieen'), all but directly prove. As illustrative of the term "gynandrosporous," and as explanatory of what he thought he had found, Mr. Archer was happy in being fortunate enough to be able to exhibit the three species of Œdogonium on the table, well showing this type of fructification. Having, however, drawn attention to its nature and peculiarities during that demonstration, it would be here unnecessary again to take up the time of the meeting by referring to the points involved. It was besides the less necessary to do so, inasmuch as in the form now shown, the fructification, upon being more closely examined, was seen to bear only a superficial resemblance to the gynandrosporous type, and, as will be seen presently, is truly monœcious, though exhibiting what is seemingly a remarkable modification of the latter type of fructification.

It may seem, and doubtless it is, a rather lame thing to come forward and to describe a new species without knowing definitely to what genus it belongs; but Mr. Archer thought himself justified in drawing attention to this plant, owing to its seemingly

very peculiar modification of the monœcious type, being in detail different from that presented by any other form described.

The present plant seems beyond doubt to be a new species, and to belong to one of the two genera Saprolegnia or Achlya. Generically considered, Mr. Archer was inclined to regard the present plant as a species of Saprolegnia. As is well known, the generic characters in this family depend on the mode of formation and evolution of the zoospores; and perhaps the doubts as regards the present plant may probably be due to its not having been examined sufficiently early, after having been taken, to gain a good insight into the characters presented in that stage. But in the absence of knowledge derived from having actually seen the zoospores, the reason for leaning to the genus Saprolegnia was, that in one instance were observed, in the mass of the plant, three seeming sporangia evacuated by zoospores, one *within* the other, each showing a terminal opening—for so far characteristic of Saprolegnia.

Setting aside, however, the generic characters drawn from the mode of evolution of the zoospores, this plant is specifically characterised (it is believed from any other Saprolegniaceous plant yet described) by its true fructification in the following manner:

Saprolegnia (?) androgyna, sp. nov.

Oogonia large, barrel-shaped or elliptic, mostly in an uninterrupted terminal series, though occasionally interstitial; the terminal oogonium the oldest in a series, the oogonia thus showing gradually different degrees of development down to the basal one, which is the youngest; the lateral male branchlets (Nebenäste, Pringsheim), with the exception of those appertaining to the lowest oogonium of a series, are not derived either from the principal stem of the plant or from any neighbouring portion of the general plant, but these are given off from the oogonium itself, which is immediately beneath the oogonium which is fertilized by them, and so on down to the basal oogonium of a series, to which are given off lateral male branchlets from the filament or stem itself immediately thereunder; the tube or cavity of each lateral male branchlet becomes shut off by a septum formed a short distance above its origin, the portion of the contents of the branchlets above the septum being the male element and developed into spermatozoids, that below the septum retaining its characters and becoming returned back into the oogonium, whence it originated in time to take part in the formation, with the remainder of the contents, of the oospores. Oospores large, about $\frac{1}{330}$th of an inch in diameter, mostly numerous, but very variable in number; sometimes, however, though very rarely, as few as even one; occasionally exhibiting what appeared to be a roundish excentric vacuole. The whole plant large and coarse as compared with other described forms in this family.

If thus, for illustration's sake, we call the upper (mostly terminal) oogonium A, that beneath it B, and that beneath the latter C, and so on down, let us suppose, to G, then oogonium A

is fertilized by the lateral male branchlets emanating from and in direct continuation with B; the oogonium B is fertilized by the lateral male branchlets, in the same way, emanating from C, and so on down to F, which is fertilized by the male branchlets emanating from G; but G is itself fertilized by the lateral male branchlets emanating from the supporting stem, for G has no oogonium beneath. So in the whole chain of oogonia, the oospores in each, the lowest one excepted, are fertilized by the male elements derived from the branchlet given off by the oogonium immediately below; and the terminal oogonium does not, of course, give off any male branchlets—they would have no duty to do, no function to perform. The contents of the oogonia, which in their turn successively give off lateral male branchlets, do not become formed into oospores until the septa are duly formed in the branchlets, and until the granular contents beneath such septa become returned back into the oogonium in time to participate in the formation of the oogonia. As takes place in other Saprolegniæ, the whole contents become used up to form the oospores.

This curious plant, then, Mr. Archer thought, presented an interesting example of a seeming confusion of parts with a maintenance of clear distinctness of function—a male-female or a female-male, yet male and female elements distinct *per se.*

On looking at the plant at first sight, from what has been mentioned, it will not appear surprising that it should have been momentarily taken as a gynandrosporous form, the lateral male branchlets, emanating from each oogonium and reaching up to the oogonium immediately above, looking not unlike dwarf male plants of independent origin seated on each oogonium; but a closer examination revealed their true nature, and proved that they were in direct continuation with the oogonium which had given them off, as it were, like the thumb to a glove. Mr. Archer had, indeed, at first spent some time in looking, but of course in vain, for the probable mother-cells of androspores; but this was when he had seen but a single specimen as yet, which did not show its true characters so distinctly as the numerous ones which afterwards presented themselves.

Mr. Archer likewise exhibited some living examples of *Saprolegnia monoica* (Pringsh.) in fruit, showing the oogonia and lateral male branchlets. He drew attention to the specific characters distinguishing that form, as well as to its smaller and more slender habit, as compared with the new form now for the first time brought forward.

Rev. E. O'Meara, A.M., exhibited beautiful examples of *Navicula convexa,* taken from seaweeds at Rostrevor. He remarked on the prudence of searching the same localities again and again, however seemingly unproductive, for objects of value will sometimes be sure to reward perseverance. He had himself frequently made gatherings from this locality, and had never

taken much of interest, and was therefore agreeably surprised at obtaining so much value in various ways as on the present occasion, as evidenced by the fine specimens now exhibited.

Dr. Moore showed some examples of an alga which he had noticed for some time forming a green scum on the surface of the water in a pan in one of the warm houses in the Botanic Garden. This production seemed to show three sufficiently well-marked states or conditions; one in which the individual rounded cells were combined into a dense, somewhat indefinitely formed cluster, occasionally presenting the appearance of being hollow in the centre; again the cells presented themselves as extremely short linear series of usually four or five cells (what might be called short filaments—four sometimes in a series, and a fifth at one side, as it were originating a branch or pseudo-branch); and again the cells presented themselves individually free, or it might be binate, owing to recent self-division. Occasionally certain cells were to be met with undergoing division in all directions of space, and sometimes some of the dense masses of cells first mentioned presented short linear series of cells seemingly emanating from their circumference. It seemed, therefore, as if the following might represent the growth so far as the phases of it to be seen were concerned:—Single, nearly orbicular, cell; binary and quaternary division; repetition of this, and in various directions of space; more or less densely compact cluster; circumferential growth; cells at periphery finally taking on growth in one direction of space only; linear series of cells detached; repetition; and, finally, a breaking up into single cells and, it might be, zoospores, many similar-looking cells occurring in an active condition in the water. This production appeared to be an annual—appearing each season, actively vegetating, and quite disappearing in no very long space of time. Dr. Moore stated he would keep a look-out as to this growth in the vessel in which it occurred, and inform the Club about it on another occasion.

Dr. John Barker exhibited alive the larval form of an unrecognised dipterous insect, remarkable for the "home" it had constructed "without hands." He had found it in the canal near Dublin. This habitation formed a case of about $\frac{1}{12}$th of an inch long, $\frac{1}{16}$th of an inch wide, and $\frac{1}{30}$th of an inch deep, and consisted of two elliptic pellucid valves (like a bivalve shell, only joined at opposite margins), and having coiled thereon a quantity of the filament of Zygnema, seemingly still in active growth; these valves were joined together at the broad margins, and were not closed at the narrower margins (or the ends). Through one of the openings thus left, the head and anterior portion of the larva mostly protruded. It did not seem able to leave the case, but it could turn round in it or retract itself altogether within its bivalve covering. It was curious to observe the almost concentric or sometimes spiral arrangement in which the creature had

adapted the coils of the Zygnema to its case, and to perceive how healthily the alga continued to live, not seemingly suffering from the use to which it had been put. When feeding or moving about, the insect carried its case much as a caddis-worm would—swaying it backwards and forwards. These specimens continued to live and move actively for about a week in confinement.

Mr. Archer brought forward *Characium ornithocephalum* (A. Br.), and what he regarded as *Ankistrodesmus convolutus* (Corda), kindly forwarded by Professor Gagliardi from Yorkshire.

Mr. Archer took occasion to mention that he had found *Sorastrum spinulosum* (Näg.), Kütz., in a gathering made near Drogheda; they were somewhat larger, but not so brightly green, as those he had shown (for the first time in Britain) taken rom the Rocky Valley, in September, 1865. (See Club minutes of that date.)

Mr. Tichborne brought before the meeting a slide which represented and, he might say, explained a phenomenon observed in crystallization. Some chemical salts and many minerals presented the peculiarity that unfractured surfaces show—an amorphous texture perfectly devoid of crystalline structure, yet, when broken through, were found to consist of exquisite geometrical forms, which were produced by needles or prisms radiating, from some axis or point, towards the amorphous circumference. The beautiful and well-known mineral Wavellite may be cited as a specimen of this characteristic crystallization, and many specimens which come under the denomination of botryoidal, mamillated, and reniform.

Many of the quinine salts presented the same peculiarity, particularly the chlorate—a salt which Mr. Tichborne has had occasion to experiment with to some extent lately. When a boiling solution of pure chlorate of quinine is allowed to cool, the solution becomes quite milky, not (as might be at first sight supposed) from a deposition of minute crystals, but (as the microscope shows) by the deposition of the salt in the form of oily globules, which on cooling become vitreous balls; these in a short time change to fine filiform masses of crystals. As the process continues, the salt is again deposited upon the periphery of the mass in an amorphous condition, at the same time becoming crystalline in the interior. The result is, in the case of this salt, most curious mushroom-shaped masses, perfectly amorphous on the exterior, but beautifully crystalline inside. The slide exhibited was procured by allowing the solution of chlorate of quinine to cool slowly upon the glass, and, when the globules were sufficiently collected, to dry rapidly in an air-pump. By this means the chlorate was retained in its vitreous condition; otherwise it becomes crystalline. It would be observed, that even here the globules seemed to arrange themselves in a symmetrical form—so

much so as to produce a rather pretty microscopic object, each large globule being surrounded by a series of small beads, fourteen to fifteen in number. The vitreous quinine did not polarize, whilst the crystalline did.

Dr. John Barker exhibited a form of growing stage or stand, contrived by him for preservation of any object on an ordinary slide under observation, by placing it in connection with a reservoir of water, from which the fluid is conducted to the object under the cover by a slip of talc. This little contrivance, which obviously presents many advantages, is described and figured in another page of the present number of this Journal, and seems to supply a desideratum.

August 16*th*, 1866.

Rev. E. O'Meara referred to his having shown, at last meeting of the Club, some specimens of *Navicula convexa* gathered at Rostrevor, county of Down, a locality which, though frequently searched by him, had never previously yielded results sufficient to reward the labour.

Upon further examination of this gathering, several interesting and uncommon Diatomaceous forms were discovered. Some of these Mr. O'Meara regarded, after careful search through all the sources of information, to be undescribed. At some future time he hoped to be able to furnish to the Club a list of the more remarkable forms found therein, but he would confine himself on the present occasion to exhibiting one which he proposed to name *Pinnularia plena*.

In a paper by Dr. Greville, published in 'Mic. Journ.,' January, 1859, Mr. O'Meara had found a form figured and described under the name of *Pinnularia semiplena*, which in many features bears a sufficiently striking resemblance to the present form, so that the latter may be ultimately identified with it. Nevertheless, upon a careful comparison of the two forms, such differences of character presented themselves to notice as to justify Mr. O'Meara for the present in regarding them as distinct.

The following is Dr. Greville's description of *Pinnularia semiplena*:—

Valves linear-elliptical, sub-acute; costæ radiate, distant, very short in the middle, and becoming gradually longer towards the extremities, leaving an elongate, lozenge-shaped, centrical blank space. Length, ·0024″; breadth, about ·0006″; costæ, 15 in ·001″.

Pinnularia plena (O'Meara) may be thus described:—Valves broadly elliptical, subacute; costæ radiate, close, becoming longer towards the centre, leaving an elliptico-lanceolate central blank space. Length, ·0024″; breadth, ·0012″; costæ nearly twice as many in same space as in *P. semiplena*.

To complete the comparison, Mr. O'Meara observed that, in

the form described by Dr. Greville, the central blank interspace seems from the figure to be smooth, traversed by a longitudinal median line, interrupted at the centre by a well-defined but small nodule. In *P. plena* an elevated siliceous band traverses longitudinally the blank interspace, imbedded in which the central median line may be traced from the extremities towards a central nodule of very large dimensions. Mr. O'Meara proposed the specific name *plena* for this form, as it seemed suitable for the purpose of denoting the affinity between it and *P. semiplena*, as well as descriptive of its characteristic differences.

Mr. Archer exhibited a plant collected by Dr. E. Perceval Wright on a recent visit to the Arran Isles. Although Mr. Archer could not see any very solid distinction between the genera Hydrocoleum (Kütz.) and Cthonoblastus (Kütz.) = Microcoleus (Harv.), yet, as regards the identification of the present form now shown, there did not seem any tangible differences between it and *Hydrocoleum thermale* (Kütz.). This occurred mixed with a number of other oscillatoriaceous plants, forming a dense felty coating on rocks. The plant itself formed groups of Oscillatoria-like filaments included within a hyaline sheath; in fact, agreeing completely with the form named *Hydrocoleum thermale*. But Mr. Archer's object, in now drawing attention to it, was to note a curious modification of the oscillatoriaceous movement evinced by these filaments. As is well known, the movement of a single free filament of an Oscillatoria consists of a vibration or spiral twisting, whereas the movement of these filaments, confined in the common tube, consisted of a gliding up and down past one another within the tube or sheath. At the central portion of the sheath the filaments appeared so closely in contact that their outlines were not very distinguishable, and the individual motion of each filament, now up, now down, lent a very curious appearance, deceptively like a circulation of contents in a longitudinal direction. That it was, however, really a gliding up and down of the filaments themselves, was abundantly proved by looking at the place where the filaments projected beyond the opening of the sheath. Here the filaments were seen slowly altering the relative proportion of each, which, at any particular time, extended beyond the opening of the sheath; so that, in this respect, the aspect of the tuft of projecting filaments was slowly but constantly changing. The filaments at the free end displayed little or no oscillatory movement, their efforts being confined to the back-and-forward motion in and out of the apex of the sheath, which itself presented a more or less broken and indefinite outline. This kind of movement of oscillatoriaceous filaments seemed sufficiently marked in the present instance to deserve this brief mention. In touching on the Oscillatoriaceæ, Mr. Archer thought it might not be out of place to exhibit Musset's paper and figures ('Nouvelles Recherches anatomiques et physiologiques sur les Oscillaires'), of which he had recently become possessed, in which

that author had sought to establish the animal nature of the Oscillatoriaceæ, and who, by assuming it as a fact, and drawing false analogies, seemed to labour under the delusion that he had proved his case. It might hardly be imagined that this memoir was written so late as the year 1861!

Mr. Archer likewise exhibited some specimens of a unicellular Alga which was referable to Nägeli's genus Synechococcus, but was not, he thought, previously recorded. It is, indeed, to be granted that no mode of reproduction, save self-division, having been observed in the lower forms of Chroococcaceæ, their tenability as species was open to doubt. But the present, as a form merely, was even more striking and marked than any described in the genus, and therefore not less entitled to a record. Nor did it appear to have been described under any other genus or name. Kützing, had he seen it, would, no doubt, have referred it to his genus Palmoglœa, as he had seemingly included therein several phycochrome-bearing forms along with chlorophyll-bearing plants. But none of Kützing's species of Palmoglœa would at all accord with the present plant. It had occurred as yet, so far as Mr. Archer's experience, only in one little shallow miniature pool on the side of Bray Head. Taken, then, as it stands, this seemed an abundantly distinct production. Mr. Archer would first give the characters of the genus Synechococcus according to Nägeli, of which the present plant was a very typical example. It is, however, to be noted, as Nägeli himself remarks, that the distinction between the genera Synechococcus, Gloeothece, and Aphanothece, may possibly not be marked by very absolute characters.

Family, Chroococcaceæ.

Genus, Synechococcus (Näg.).

Generic characters.—Cells elongate, division only in one direction, with thin walls, single or united into little families in series.

Synechococcus crassus, sp. nov.—Cells broadly elliptic, about one half longer than broad; cell-wall very thin.

This plant is well distinguished from even the largest of Nägeli's species, *S. æruginosus*, by its still larger size and by its elliptic or egg-shaped cells, somewhat narrowing towards the gradually rounded ends, not cylindrical, with rotundato-truncate ends. In the present plant the cell-wall is very thin, and seemingly without any gelatinous investment. It would, Mr. Archer thought, be altogether unnecessary, if not, indeed, absurd, to contrast the form in question with any other unicellular plant similar in size or resembling in shape, containing chlorophyll, such as Penium, Cylindrocystis, &c.; and, due regard being had to the generic characters, and the form and dimensions of the cells themselves, Mr. Archer thought that neither was there any danger whatever that the present plant could be confounded with any of the related described Chroococcaceæ. When occurring in sufficient quantity on the slide, this plant, presenting, as it does, in a marked degree, the characteristic bright æruginous green colour of phycochrome, forms an exceedingly pretty object.

Mr. Archer also exhibited a fine gathering, quite pure from other forms, of *Micrasterias Thomasiana* (ejus), taken from a pond adjacent to that in which he had found it first; since then he had met with this form exceedingly sparingly, hence a copious gathering was the more welcome.

September 20th, 1866.

Mr. Crowe exhibited an abundant gathering of *Stephanosphæra pluvialis* and *Gonium pectorale*, in great beauty and activity, obtained from the old Bray-Head Station. The latter showed very varied sizes and states of division, and the whole formed a very handsome object.

Rev. Eugene O'Meara, A.M., had much satisfaction in bringing before the notice of the Club a most interesting and productive gathering of diatoms, collected by Dr. E. Perceval Wright whilst dredging, in from fifteen to thirty fathoms, off the Arran Islands, in the month of August last. This contained many rare forms, as well as others which appeared to be new. He (Mr. O'Meara) had only received the material a few days ago, and, as was to be expected from the circumstances under which the gathering was made, it was very dirty, requiring much care to render it tolerably clean; therefore as yet he had been able to give the material only a cursory examination, and would defer more detailed observation to some future time. He thought, however, what he had stated as to the value of the gathering would be justified by an inspection of the slide now exhibited.

On the present occasion he would draw attention to one form only, which he would designate *Pinnularia divaricata*, and described it as follows:—Length of frustule about ·0057″, breadth about ·0035″. Side view broadly elliptical; the ends slightly produced, broad and rounded; the central space large, its outline resembling the vertebra of a fish. Through this space there runs a well-marked median line, very fine at the outward extremities, but becoming broader towards the centre, at some little distance from which point it terminates in a small bulb. The costæ are arranged concentrically with the apex at both ends for about a fourth of the length of the frustule, and in the intermediate portion spring from the margin of the central nodule; the central costa runs at right angles with the longitudinal axis, and those at either side radiate towards the central costa more and more so as the distance from this line increases. The costæ in the central portion of the valve are furcate; in some the furcation appears near the outer margin of the valve, in others near the central nodule. Some few are bifurcate. Still further it seems worthy of attention that the costæ are slightly notched by longitudinal

lines, which, though they furrow them, do not sink so deeply as to give a moniliform character to the striæ.

Dr. M. H. Collis exhibited Vorticella, beautifully showing the process of gemmation in various stages, from the first faint indication of a commencing protuberance, the young gemma, up to the fully formed animal ready to become disengaged from the parent.

Dr. John Barker showed a Carchesium, forming a beautiful object; but he drew attention to it chiefly to point out a curious, seemingly parasitic, filamentous growth, fringing the stipes of the animal, and often forming a more or less dense, ruffle-like, annular tuft round the stipes, just under the animal. These little fibres were exceedingly delicate and colourless, and Dr. Barker would regard them as fungoid.

Mr. Archer ventured to think these delicate filaments might fall under some of Kützing's more slender forms of Leptothrix, and they seemed to him, at least, although the *habitat* was seemingly novel, to be the same thing as the minute filaments or delicate fibres one sees more or less frequently attached to diatoms and other various objects in the water.

Mr. A. Andrews exhibited some beautiful slides of crystals of sulphate of copper, made by Mr. Davis, similar to those figured and described by him in the 'Quart. Journ. Mic. Science,' N. S., No. XIX, July, 1865, p. 210. These formed magnificent objects when viewed with polarized light.

Mr. Archer brought forward a curious form of Chytridium (A. Br.), which he believed to be new. He had found it living upon the joints of Zygnema, and it was seemingly remarkable that it nearly always attacked the shortest joints. The gathering had been made by him in Callery Bog. As the form was first noticed in the company of Dr. J. Barker, and, indeed, was first drawn attention to by him, he would venture to take the opportunity to name this very distinct form after that gentleman.

The following may serve as a description:

Genus, Chytridium (Al. Braun).

Chytridium Barkerianum, sp. nov.—Cells much depressed, three- or four-lobed, the lobes broadly rounded; upper surface of the cell concave, bearing at the centre a vertical, hyaline, very slender, terate, minutely capitate process; the cell-contents mainly confined to the centre, leaving the ends of the lobes empty; zoospores making their exit through the opened apices of the lobes.

As regards the affinities and differences of this curious little species, it would seem that the only forms at all immediately re-

lated to it are *Chytridium cornutum* (Al. Braun) and *C. transversum* (A. Br.); but the projections or lobes of the former species are numerous, narrower, and quite irregularly disposed and variable in size and form, the general form of the cell itself being globular—not, as in the present species, the lobes in one plane and equal in size, and three or four only, and the general form of the cell itself being depressed; and in the latter species the minute projections are two, and opposite and minute—not four, and in the same plane and large. In the present form there is no rounded body, the sides in top view are concave, and the whole cell is constituted by the lobes. But the present form is also distinguished from the species mentioned (and, so far as Mr. Archer was aware, every other species also) by the possession of the curious vertical, slender, hyaline process, with the minute knob at the apex, starting from the centre of the somewhat concave upper surface of the cell. What the nature of this curious appendage may be it would be hard to guess. The minute knob-like head, like the stem or process on which it is borne, is hyaline. Occasionally a free globose body, similar in size and appearance to this knob or head, was to be seen close beside it, leading to the idea that it might be detached and renewed. The zoospores make their exit from the opened ends of the radiating lobes, and their motion, like that of those of most of these forms, seems but faint and short-lasting. The cell-contents of the joint of the Zygnema, on which these Chytridia were established, were always effete and brown-coloured, and destroyed. As has been remarked, it was mostly the shortest joints of the Zygnema which were so attacked by this parasite, but occasionally a long one was so, and on one occasion five or six were noticed on one very long joint. Occasionally the attachment and root-like appendages of the Chytridium could be seen penetrating into the Zygnema-cell, but more frequently, on a lateral view, the parasite seemed to be seated merely superficially thereon, and without any apparent means of attachment, as happens in other forms of Chytridium. It might seem, possibly, that after the Chytridium had become fully grown the root-like appendages might become resorbed. Mr. Archer ventured to think that this little plant, the most marked in figure of any of the genus, might not be without some interest, in case it may be detected elsewhere by other observers.

Quekett Microscopical Club.

University College, London.

September 28*th*.—W. Hislop, Esq., Vice-President, in the chair. Eight members were elected, and several donations were announced.

A paper was read by Mr. R. T. Lewis "On some of the Effects of the Electric Spark." (See 'Journal,' p. 14.)

October 26th.—Ernest Hart, Esq., President in the chair.

The following resolution, passed by the Committee, was announced:—"That the Committee of this Club desire to express their sense of the loss they have sustained in the death of Mr. Richard Beck, who was one of the founding members of the Club, and of whose great services to Microscopic Science and amiable personal qualities they have a deep appreciation."

Twenty-eight members were elected, and several donations to the Cabinet and Library were announced.

The Excursion Committee reported the results of a field-excursion to the Royal Gardens, Kew, on the 6th instant; and a special vote of thanks to Dr. Hooker was passed, for the privileges so liberally accorded to the members of the Club on that occasion.

Mr. Highley, F.G.S., read a paper "On Shore Collecting," in which he described the dress and implements which he considered most suited for the purpose, how to search the shore, and what animals, microscopic or otherwise, were most likely to be found.

A *conversazione* followed, at which many objects of interest were exhibited, one of which was a new form of microscope, of novel construction, by Mr. Cole.

November 23rd.—The President in the chair.

Nineteen members were elected.

A box of slides from W. B. Richardson, Esq., F.R.C.S.I., of Dublin, as well as several donations from the members, were announced.

Mr. M. C. Cooke read a short paper "On the best methods of transmitting Slides by post." (See 'Journal,' p. 63.)

Mr. McIntire read a paper "On the different kinds of Poduræ," in which he described their history and habits, how to mount and examine their scales, and his experience in breeding them for microscopic investigation.

Mr. N. E. Green read a paper "On Melicerta," being the result of long and careful inquiry into their habits and structure under high powers, and in thin glass cells especially contrived for that purpose.

Both these papers were illustrated by drawings, mounted slides, and living specimens.

The proceedings closed with a *conversazione.*

Manchester Literary and Philosophical Society.

MICROSCOPICAL AND NATURAL HISTORY SECTIONS.

October 8th, 1866.

A. G. Latham, Esq., President of the Section, in the chair.

Mr. Hurst read a paper "On the Plants springing up spontaneously on the fresh turning-up of pasture-land at Knutsford, Cheshire."

"On *Echinus lividus*, illustrated by specimens from Roundstone," by Thomas Alcock, M.D.—The author described particularly the mechanism of the teeth and jaws of the animal, and showed by a dissection of the parts that the statement made both by Professor Owen and Professor Rymer Jones that the striated surfaces of the jaws are used to comminute the food is incorrect, for the whole of these surfaces is occupied by muscle, and is altogether outside the pharynx through which the food passes. He further showed that the food contained in the alimentary canal consists of very coarse pieces of sea-weed and zoophyte, which have evidently not been subjected to the action of any triturating apparatus. He exhibited mounted specimens of the suckers, and also of the sucker-plates cleaned in potash. He said Professor Owen quotes Professor Valentin with regard to the Pedicellariæ, and states that there are three forms of them belonging to *Echinus lividus*, namely, gemmiform, tridactyle, and ophiocephalous Pedicellariæ:—these were exhibited as mounted specimens, and with them a fourth kind, quite distinct from all three, and the most remarkable in form; it has long slender jaws like those of a crocodile, armed, in this species, with one very long terminal tooth and one tooth on each side not far removed from it. He remarked that in *Echinus sphæra* all four kinds of Pedicellariæ are found, and agree in their general character with those of *Echinus lividus*, though they are sufficiently different to be readily distinguished, and the fourth kind just mentioned has, besides the long terminal tooth, a series on each side of six or seven recurved teeth, suggesting the name sauriocephalous as an appropriate one for this form. Mounted specimens of the four kinds of pedicellariæ of *Echinus sphæra* were shown for comparison with those of *Echinus lividus*, together with suckers and sucker-plates, and the buccal membrane mounted entire to show the ophiocephalous and gemmiform pedicellariæ complete and in their natural position.

"On the Structure of the Spines of *Echini*," by H. A. Hurst, Esq.—Notwithstanding the general appreciation by microscopists of the spines of Echini, the author has been unable to find any satisfactory account of their structure; and he attributed this to

the fact that the examination of these objects had been chiefly confined to their sections, mounted in Canada balsam, which frequently has the effect of making transparent objects too transparent. He recommended for this purpose, however, the use of Smith and Beck's semi-paraboloid Lieberkuhn, together with transmitted light—cutting off either means of illumination by a slight motion of the hand, or using both together; but the readiest means of ascertaining their real structure he found to be the examination of unmounted and splintered ends of broken spines by incident light, a method bringing out details and showing the connection of parts in a manner superior to any other. It was with diffidence he dissented from Dr. Carpenter's views in the last edition of his work on the microscope; but he begged to propose the following as more in accordance with the appearances of structure presented by these spines under the microscope. They are composed of two substances in outward appearance, though chemically perhaps the same, one so perfectly homogeneous and transparent when viewed by transmitted or polarized light that it cannot be distinguished from the blank field of the miscroscope—yet, under incident light, so dark and opaque as to appear black. This substance is frequently traversed by winding anastomizing channels, which, though only containing air, seem opaque, and show as solid by transmitted light, the substance they traverse itself being invisible. He had not satisfactorily made out the structure of the second substance; it resembled the pith of plants, but it was less regularly cellular, and in some spines assumed a fibrous appearance. It is opaque under transmitted, and glistening white under incident light. In the following remarks he called this opaque, and the first-described transparent substance. The general structure of the spines he had examined was also twofold in the simpler, as the *Amphidotus cordatus*, the centre portion is hollow; in the more complicated it is composed of the opaque substance perforated along the length of the spine by vertical solid tubes of the transparent matter, without any definite arrangement. These appear to increase only in length; hence a section at the apex of the spine shows in the centre a prolongation of the oldest portion, the thickening of the spine arising differently, as subsequently explained. The hollow centre of the *Amphidotus cordatus* is surrounded by a cellular fretwork of the transparent matter, while around this is a circle of solid ribs or pillars of the same, smooth on the exterior of the spine, but within beautifully hollowed out into what the heralds call an engrailed outline, the points of which connect it with the inner layer of cellular fretwork. This framework is occasionally wanting, and the engrailed points are simply connected with each other by a straight inner line of transparent matter. In the more complicated forms he was not satisfied he had ascertained the real structure, but thought it to be as follows:—The tubes of transparent matter noticed about the central opaque substance, as they approached towards the circumference of the first season's

growth, gradually coalesce, and, at a certain distance from the centre, consolidate into a rib or pillar, which runs from the root to the apex of the spine, forming a longitudinally furrowed exterior, caused by the centre of each rib projecting slightly. Once this consolidation of tubes into ribs effected, the growth changes, the ribs extending eccentrically into plates radiating from the centre, and separated from each other by a mass of tissue similar to that at the centre. At the close of the second period of growth these plates thicken concentrically so as almost to touch each other, which, however, they do not, leaving a furrow of separation. They then continue their radiating extension till the end of another year's growth, when the concentric thickening into an outer rib again takes place, and so on in successive years. These radiating plates are horizontally perforated by circular apertures bearing a singular resemblance to rivet-holes in boiler-plates, and appear to have rivets passing through them of the opaque substance in a fibrous state. Altogether the structure of the spine may be compared to that of an iron tubular bridge. The thickened exteriors of these plates are highly coloured, and traversed by winding, anastomizing channels containing air; in some portions of the spine, the opaque substance either grows into, or is destroyed and replaced by, the transparent substance, which then forms a solid mass, perforated by the rivet-holes, now changed into winding, anastomizing passages. Forms intermediate between the extremes of complexity and simplicity were those of *Echinus sphæra* and *lividus; Echinus sphæra* being chiefly composed of the pith-like substance, with twenty-five or thirty radiating glassy plates of a whitish colour; while *Echinus lividus* was more solid, the pith-like substance passing into the solid glassy radiating plates through portions consisting of this glassy matter, perforated by anastomizing channels.—Mr. Hurst was not able to say whether the pithy and glassy substances are distinct or not; but while the cellular matter leaves no trace after the prolonged action of vinegar, the transparent glassy substance, as well as the exterior of the spine, appears to be enveloped by a membrane, resisting the action of vinegar, which curiously converts this solid, opaque, hard, and brittle spine into a transparent, flexible body, retaining its original form. By using direct sunlight and a semi-paraboloid condenser, the glassy matter could be distinctly seen through, even when viewed as an opaque object, and the arrangement of the cellular matter ascertained. It is this transparent substance which is tinged with the beautiful purple hue so well known to microscopists. Mr. Hurst expressed his disappointment that the use of polarized light in these observations had led to no result, and thought its value had been over-estimated.

November 13th.

J. SIDEBOTHAM, Esq., in the chair.

The Secretary read a paper, by Mr. G. E. Hunt, "On Mosses new to Great Britain since the publication of Wilson's 'Byologia Britannica.'"

Mr. Sidebotham exhibited three new British insects—*Notodonta bicolora*, *Sesia phitantiformis*, and *Dianthœcia cæsia*.

Mr. Hurst presented twelve slides of spores of Fungi obtained by the method recommended by Mr. Sidebotham—that of placing the Fungi on slips of glass, and allowing the spores to be gradually shed thereon, thus showing the arrangement of the gills, while at the same time furnishing an interesting object for microscopic study.

Mr. Sidebotham suggested that as the higher powers of microscopic object glasses could not be used without great difficulty, the attention of opticians should be given to the discovery of eye-pieces of higher magnifying power than those now in general use, and cited instances of the advantages to be derived from this.

OBITUARY.

CHRISTOPHER JOHNSON.

Christopher Johnson, Member of the Microscopical Society of London, was born at Lancaster July 23rd, 1782, and died at Lancaster June 21st, 1866. His father, a surgeon in practice at Lancaster, contributed several communications on medical and surgical subjects to the London medical journals near the close of the last century. When a young man, Mr. Johnson devoted himself laboriously to the study of chemical and electrical science. He graduated at Edinburgh, after a three years' course of medical instruction at the Royal Infirmary. He then commenced practice in Settle, in Yorkshire, where he remained till 1808, when he returned to Lancaster. In 1813 he published a translation of an essay on 'Child Murder,' by Dr. P. A. O. Mahn, of Paris. In 1817 he translated the whole of 'Orlando Furioso' into prose. In 1832 he contributed in the local press a series of sanitary papers with reference to the impending cholera. He contributed a manual called 'The Nurse' to a series edited by Martin Doyle, 1842. In 1841 he published several articles on agricultural chemistry in the local papers. About ten years later, he published others under the signature of "A Fireside Farmer," in which he explained the views of Dumas and Boussingault, and other physiological chemists. In 1848 he commenced the study of diatoms, which he followed with unwearied diligence till within a brief period of his death. In 1849 he translated Menighini's work on the animal nature of the Diatomaceæ, which was published by the Ray Society. In 1865 he published some papers on the disinfecting properties of carbolic acid, the last of which was printed in the 'Lancaster Gazette' in November, 1865. He was one of those quiet workers with the microscope who did much for diffusing a taste for the investigation of minute organisms by his continuous work at the forms of Diatomaceæ.

ORIGINAL COMMUNICATIONS.

On the PROTOPHYTA* *of* NEW ZEALAND. By W. LAUDER LINDSAY, M.D., F.R.S. Edin., F.L.S., &c.

COMPARED with what has been already achieved, there remains, in certain departments of the Flora of New Zealand, much more yet to be accomplished—much that can probably only be properly executed by the resident or local botanist, who can leisurely study *living* forms on or near the locality of their growth. Of no groups of plants is this remark so true as of the *Protophyta*—the *Desmidiaceæ*, *Diatomaceæ*, and *Palmellaceæ*. The first and the last may be said to be almost or quite unknown; while our knowledge of the *Diatomaceæ* of the New Zealand islands is nearly altogether confined to my own local and limited collection from the neighbourhood

* I quite concur with Prof. Smith and other systematists in separating the *Diatomaceæ* and *Desmidiaceæ* from the *Algæ*, as a distinct order—*Protophyta*, which so far corresponds to the *Protozoa* of the animal kingdom. There is quite as good ground for the separation in the one case as in the other; the strongest argument, however, being, I believe, that derived from the convenience of the student and classificator rather than that any precise line of demarcation has been discovered by systematists. Such lines of demarcation, though plentiful in book classifications as "systems" so-called, are rarely, if ever, to be found in nature. For instance, as I have elsewhere shown ("On *Arthonice melaspermella*," 'Journal of Linnean Society,' 'Botany,' vol. ix, p. 268; "Observations on Otago Lichens and Fungi," 'Trans. Royal Society of Edinb.,' vol. xxiv, p. 434), there is no real separation between *lichens* and *fungi*, or between *lichens* and *algæ*, though such a separation is assumed by all systematists. "*Natura non facit saltum:*" her divisions are not definable by the "characters" of the systematist; she exhibits in both kingdoms a *continuity of variation* whereby *variety* passes into *species*, species into *genus*, and genus into *order*. The divisions of the systematist are artificial, arbitrary, provisional, and matters of convenience: the "species" of one botanist is not that of another, and what is a species to-day may become either a variety or perhaps even a genus to-morrow; every addition to our catalogue of plants—every contribution from new countries or areas—leads to some modication of existing systems of arrangement and nomenclature.

of Dunedin, in the province of Otago.* There is here, therefore, for the local botanist, not only a most extensive and varied, but almost untrodden, field of research; and it is with a view to incite him to cultivate this most promising field that I venture to offer the following remarks. While the work of *collection* is comparatively easy, that of *examination* is far from being so. All the groups in question require the laborious care of the skilled microscopist; and labourers of such a class are not numerous, either in a new colony or at home. But there is no reason why *collectors* should not be numerous—why they should not supply the materials for work to the systematist in his cabinet. The collector, and the examiner or describer, are necessary complements to each other. While the latter seldom has opportunity to collect over wide areas, he can utilise the materials supplied by the less skilled travellers who have such opportunity: so that each has his appropriate and indispensable place in the advancement of science.

I. *Diatomaceæ.*

Considerable numbers are recorded as natives of Australia, having been there systematically looked for and examined. My friend Dr. Roberts, of Sydney, has, for instance, long devoted himself to the examination of the diatoms of Australia and its adjoining seas; and the addition of numerous new and interesting forms has already been the result of his single labours. But in New Zealand I am aware of no resident botanist, and no traveller save myself, who has given himself even the trouble of limited or superficial collection. In one of his letters to me (of date June 6th, 1861) Dr. Greville, however, says, "Some very interesting gatherings of them have already come from that country;" but I can find no trace of any published record thereof. In these circumstances, the following list of species, collected by myself in a very limited area, and under most unfavorable conditions, may be useful to the local botanist, stimulating and encouraging his zeal, perseverance, and industry, by showing what

* "*On the Diatomaceæ of New Zealand*," 'Journal of Linnean Society,' 'Botany,' vol. ix, p. 129. Mr. Carruthers, F.L.S., of the British Museum, writes me [letter 14th Dec., 1866], "I believe no list of New Zealand diatoms has been published except your own. Greville had gatherings from New Zealand, and had distributed some slides, so that some New Zealand diatoms were in this way known; but only in this way, I believe." A scrutiny of Rabenhorst's 'Flora Europæa Algarum' (1864) reveals only three recorded New Zealand forms; viz., *Cocconeis cœlata*, Grev.; *Navicula Johnsoniana*, Grev., and *Hyalosira Beswickii*, Norman; whereof the two former were described in this Journal and the last in Pritchard's 'Infusoria.'

fruits may be expected from more systematic collections over wider areas, and in different parts of an extensive and varied colony.

Enumeration of *Freshwater Diatomaceæ*, collected in the vicinity of Dunedin, Otago, in 1861:—

Genus 1. *Epithemia.*

Species 1. *gibba*, Ehrb.

Occurs also in the Geysers of Iceland and the lakes of Switzerland.

2. *musculus*, Kütz.

3. *Westermanni*, Ehrb.

Occurs also in Ceylon.

4. *Zebra*, Ehrb.

5. *turgida*, Ehrb.

6. *Sorex*, Kütz.

Previously found in New Zealand; fresh or brackish water; precise locality unknown (Smith).*

Genus 2. *Eunotia.*

7. *gracilis*, Sm.

Genus 3. *Himantidium.*

8. *pectinale*, Kütz.

Occurs also in France (at 6000 ft. in Auvergne), Italy, Sweden, Russia, and other parts of Europe (Rabenhorst).

9. *bidens*, Ehrb.

Genus 4. *Meridion.*

10. *circulare*, Grev.

Occurs also in France (at 3000 ft. in Auvergne) and throughout Europe (Rabenhorst).

11. *constrictum*, Ralfs.

Occurs also in France (at 5577 ft. in Auvergne) and throughout Europe (Rabenhorst).

Genus 5. *Denticula.*

12. *tenuis*, Kütz.

Occurs also in France and throughout Europe (Rabenhorst).

Genus 6. *Odontidium.*

13. *mutabile*, Sm.

„ 7. *Fragilaria.*

14. *capucina*, Desm.

* 'Synopsis of the British Diatomaceæ,' by Prof. Smith: London, 1853 and 1856. Vol. II, preface xxvii.

Genus 8. *Nitzschia.*

15. *parvula*, Sm.?

Smith describes *parvula* as *marine*, but my collection contains no marine forms; so that this diatom, which was considered as doubtfully referable to *parvula* by Dr. Greville, may really prove to be another species.*

16. *Amphioxys*, Ehrb.
17. *minutissima*, Sm.
18. *spathulata*, Bréb.

This also is recorded by Smith and Rabenhorst as *marine*, while in Otago it occurred in fresh water, though in lagoons near the coast, and sometimes flooded by the sea.

Genus 9. *Homœocladia.*

19. *sigmoidea*, Sm.

„ 10. *Synedra.*

20. *minutissima*, Kütz.
21. *radians*, Kütz.

A common British form, almost cosmopolite, previously found in New Zealand (Smith).

22. *tenuis*, Kütz.

Occurs in Germany and France, but not British (Pritchard).† Throughout Europe, however, says Rabenhorst, p. 136.

23. *delicatissima*, Sm.
24. *tenera*, Sm.
25. *Ulna*, Ehrb., and var. β. Sm.

Occurs also in Ceylon.

26. *acuta*, Ehrb.

Occurs in America, Asia, Africa, and Australia. Not British (Pritchard). Throughout Europe (Rabenhorst).

27. *fasciculata*, Ag.

Genus 11. *Cymatopleura.*

28. *apiculata*, Sm.

In my list of Otago Diatomaceæ, given in the Linnean Society's 'Journal,' vol. ix, p. 132, this genus and species are erroneously omitted; but the error was corrected by Dr. Greville in a letter to me of March 5th, 1866. Regarding this species Mr. Carruthers writes me‡ that it "is considered as

* Rabenhorst, 'Flora Europæa Algarum' (1864), p. 154, describes it as both freshwater and marine.

† 'History of Infusoria,' 4th ed., 1860. Section on "Diatomaceæ," by Ralfs.

‡ Letter, 14th December, 1866.

only an apiculate variety of *C. Solea*. It is British. But if it be rightly referred to *C. Solea*, its distribution is world-wide."

Genus 12. *Tryblionella.*

29. *gracilis*, Sm.
30. *debilis*, Rylands. In MSS. inedit. [*fide* Greville.*]

Mr. Carruthers† informs me that *T. debilis* "is only a MS. name for a European species, found as well in Britain. Grunow has distributed it under the name of *T. Sauteriana*, and this, I believe, is the name it is likely to retain. It is not yet published under any name, although it is well known through the distributed slides."

31. *angustata*, Sm.
32. *levidensis*, Sm.

Genus 13. *Surirella.*

33. *biseriata*, Bréb.

Both recent and fossil: throughout Europe, North and South America, and the Cape (Rabenhorst).

34. *linearis*, Sm.
35. *splendida*, Ehrb.
36. *tenera*, Greg.
37. *ovata*, Kütz.
38. *minuta*, Bréb.
39. *elegans*, Ehrb.

Genus 14. *Campylodiscus.*

40. *cribrosus*, Sm.

Recorded by Smith as a *marine* or brackish-water form. Occurs also in North America.

Genus 15. *Diatomella.*

41. *Balfouriana*, Grev.

" 16. *Cyclotella.*

42. *operculata*, Kütz.
43. *Kützingiana*, Thw.?
44. *punctata*, Sm.
45. *minutula*, Kütz. British (Rabenhorst).

" 17. *Hyalodiscus.*

46. *subtilis*, Bail.

Occurs at Halifax, Nova Scotia. Neither genus nor species is British (Pritchard) or European (Rabenhorst).

* Letter, March 5th, 1866.
† Letter, 14th December, 1866.

Genus 18. *Melosira.*

47. *subflexilis,* Kütz.

Occurs also in France (Smith) and throughout Europe (Rabenhorst).

48. *varians,* Ag.

49. *orichalcea,* Mert.

Genus 19. *Actinoptychus.*

Dr. Greville remarks,* "Smith made a blunder, and Ralfs (in Pritchard's 'Infusoria') restored the name."

50. *undulatus,* Kütz.

Occurs in America (in guano, &c.); not British (Pritchard).

Genus 20. *Cocconeis.*

51. *Pediculus,* Ehrb.

52. *Placentula,* Ehrb,

" 21. *Achnanthidium.*

53. *lanceolatum,* Bréb.

Occurs also in France (at 3000 feet in Auvergne) (Smith), and in most parts of Europe (Rabenhorst).

54. *lineare,* Sm.

55. *coarctatum,* Bréb.

This and the preceding occur also in France (Smith): the latter in many parts of Europe (Rabenhorst).

56. *trinode,* Arn.

Genus 22. *Achnanthes.*

57. *exilis,* Kütz.

Occurs also in France (Smith) and throughout Europe (Rabenhorst).

Genus 23. *Cymbella.*

58. *cuspidata,* Kütz.

Occurs also in Nova Scotia (Smith).

59. *obtusiuscula,* Kütz.

Occurs in Europe, but is not British (Pritchard).

60. *Helvetica,* Kütz.

61. *Lindsayana,* Grev.

"Descriptions of new species of Diatoms from the South Pacific," 'Trans. Botan. Society of Edin.,' vol. viii, p. 234; plate 3, figs. 5—8.

"Valves lanceolate; slightly contracted beneath the obtuse apices; often with nearly equal sides. . . . . A beautiful

* Letter, February 17th, 1866.

species, varying considerably in size and in relative length and breadth. Sometimes the sides are conspicuously unequal; . . . . but generally the inequality is small and often scarcely, if at all, perceptible; so that valves might pass for a *Navicula* were it not for an indescribable facies which to the initiated eye proclaims its true position. The apices are neither capitate nor produced; but a slight contraction just beneath them produces a very characteristic effect. As is common among species both of *Cymbella* and *Cocconema*, the frustules vary much in length and breadth. In length they range from ·0025″ to ·0035″, and in breadth the shortest specimens are often equal to the longest: the average being about ·0007.″ The striæ are about 19 in. ·001″."

C. apiculata, which was included in my list of Otago Diatomaceæ published in the 'Linnean Society's Journal,' was an error subsequently rectified by Dr. Greville.* The diatom in question was really *Cymatopleura apiculata*, belonging to the family *Surirelleæ*.

Genus 24. *Cocconema.*

62. *lanceolatum*, Ehrb.

Occurs also in North America; previously found in New Zealand (Smith).

Genus 25. *Amphora.*

63. *ovalis*, Kütz.

,, 26. *Gomphonema.*

64. *constrictum*, Ehrb.
65. *curvatum*, Kütz.
66. *cristatum*, Ralfs.
67. *Augur*, Ehrb.

Occurs in Europe, Asia, Africa, America, and Australia, but not British (Pritchard). Throughout Europe (Rabenhorst).

Dr. Greville remarks,† "May or may not be *British*. If it be considered a variety of *G. cristatum*, it *is* British. Smith is doubtful. I have considered it as distinct and *not* British."

68. *tenellum*, Kütz.
69. *intricatum*, Kütz.
70. *Vibrio*, Ehrb.
71. *dichotomum*, Kütz.
72. *æquale*, Greg.

* Letter, March 5th, 1866.
† Letter, February 17th, 1866.

Genus 27. *Navicula.*

73. *lævissima,* Kütz.
74. *Cocconeiformis,* Greg.
75. *Claviculus,* Greg.

Recorded as *marine* by Smith.

76. *elliptica,* Kütz.
77. *inflata,* Kütz.
78. *pusilla,* Sm.
79. *crassinervia,* Bréb.
80. *cryptocephala,* Kütz.
81. *affinis,* Ehrb.
82. *rhomboides,* Ehrb.
83. *lanceolata,* Ag.
84. *cuspidata,* Kütz. Var. *Craticula,* Ehrb.
85. *scita,* Sm.
86. *firma,* Kütz.

Fossil in Italy (Rabenhorst).

87. *tumida,* Bréb.

Marine and littoral (Rabenhorst).

Genus 28. *Pinnularia.*

88. *major* Sm.
89. *viridis,* Sm.

A fresh-water form, occurring in Nova Scotia and other countries; previously found in New Zealand (Smith).

90. *acuminata,* Sm.
91. *peregrina,* Ehrb. Marine (Rabenhorst).
92. *radiosa,* Sm.
93. *viridula,* Sm.
94. *Stauroneiformis,* Sm.
95. *gibba,* Ehrb.
96. *mesolepta,* Ehrb.
97. *interrupta,* Sm.
98. *subcapitata,* Greg.
99. *borealis,* Ehrb.

Occurs also in France (at 4000 ft. in Auvergne), Smith: and throughout Europe (Rabenhorst).

Genus 29. *Stauroneis.*

100. *constricta,* Ehrb.

Occurs in Africa, Chili, and Australia: but not British (Pritchard). Dr. Greville remarks*:—"I have considered it distinct. If it be held distinct, it is *not* British. Smith quotes it *doubtfully* under *Achnanthidium coarctatum.*"

* Letter, Feb. 17th, 1866.

Rabenhorst (p. 108) also records it under *A. coarctatum* as British.

101. *anceps*, Ehrb.

Occurs also in Europe, Asia, Africa, and America (Smith).

102. *linearis*, Ehrb.

Occurs also in America (Smith).

103. *platystoma*, Ehrb.

Occurs also in Germany, America, and Asia: but not British (Pritchard). Switzerland and Southern France (Rabenhorst).

104. *Phœnicenteron*, Nitz.

Occurs also in Sicily (throughout Europe, Rabenhorst) and North America (Smith).

105. *gracilis*, Ehrb.

Occurs also in North America (Smith).

106. *scaphulæformis*, Grev.

"Descriptions of New and Rare Diatoms," 'Quart. Journ Mic. Sci.,' July, 1866, p. 85, Pl. IX, fig. 32.

107. *rotundata*, Grev.

Ibid., p. 85, Pl. IX, figs. 30, 31.

Genus 30. *Mastogloia.*

108. *lanceolata*, Thw.

Marine and littoral (Rabenhorst).

Genus 31. *Colletonema.*

109. *vulgare*, Thw.

Occurs also in France (Smith): and throughout Europe (Rabenhorst).

110. *neglectum?* Thw.

The most interesting feature of the foregoing list is the very large proportion of genera and species that are *British.* Of 31 genera, only 1, or 3·22 per cent.; while of 110 species only 11, or 10 per cent., are *not* British. The solitary genus in question is *Hyalodiscus:* while the species are *H. subtilis, Actinoptychus undulatus, Synedra tenuis, S. acuta, Cymbella obtusiuscula, C. Lindsayana, Gomphonema augur, Stauroneis platystoma, S. scaphulæformis, S. rotundata,* and *Surirella elegans.* This proportion (90 per cent.) of British forms is much larger than what obtains in any other class of plants collected by me in New Zealand,* and is greater,

* The nearest approximation occurs in the *Lichens,* 50 per cent. of which are common to Britain ("Lichens of Otago, New Zealand," 'Trans. Botan. Society of Edin.,' vol. viii, p. 357).

perhaps, than we should *à priori* have been led to expect in the circumstances.

A second feature of interest is the large proportion of forms which are not only common fresh-water species in Britain, but are *cosmopolite*, occurring in most different parts of the world, under great variety of climate, latitude, and elevation, including the heights of the Himalayas and Andes. This category embraces, *e. g.*, *Synedra radians, S. Ulna, Stauroneis gracilis, S. anceps, S. Phœnicenteron, Pinnularia viridis, P. borealis, Cocconema lanceolatum, Colletonema vulgare, Epithemia gibba, Navicula claviculus.**

Equally important and even more encouraging to the local botanist is the fact that a superficial collection, hurriedly made by a traveller in a most limited area, near a capital town, contains three new species, viz., *Cymbella Lindsayana, Stauroneis scaphulæformis,* and *S. rotundata,* or 2·72 per cent. These are necessarily, so far as we yet know, restricted in their distribution to New Zealand: though the analogy of other species renders it at least probable that they will yet be found to possess a wider range.

Of the 110 species enumerated in the foregoing list, *none* are recorded in the latest general catalogue of Diatoms (in English)—that of Ralfs, in Pritchard's 'Infusoria' (4th ed., 1860)—as having been previously found in New Zealand: while in the earlier 'Synopsis' of Smith (1853 and 1856) only three are so recorded, viz., *Epithemia Sorex, Pinnularia viridis,* and *Cocconema lanceolatum.*

A knowledge of the geographical distribution—of the nature of the habitats—of the botanical relations of Diatoms in other parts of the world in which they have been thoroughly studied—cannot fail to assist the local botanist in his search for, and examination of, New Zealand forms. Hence no apology seems necessary for introducing here the following general observations:

I doubt whether any other group of plants has a wider geographical range than the Diatomaceæ †—whether any will

* Smith's "Synopsis," vol. II., preface, xxvii.

† It is a well-recognised *law*, admirably discussed by Alph. De Candolle as regards *plants*, that "the *lower* any group of organisms is, the more widely is it apt to range" (Darwin, 'Origin of Species,' 4th ed., 1866, p. 481); and the late Prof. Gregory, of Edinburgh, who distinguished himself during the latter years of his life by his devotion to the theory of the Diatoms of Scotland, remarks, "These organisms are far less affected by climate and temperature than larger plants or animals, since many of the very same species are found in every latitude and in every country......and there is absolutely no difference between the exotic and the British forms" ('Proceed. Botan. Soc. Edin.,' 1855, p. 71).

be found, when thoroughly known, to exhibit a greater number of cosmopolites, a larger proportion of species which are independent of the usual restrictions of climate or latitude, elevation or depth, aqueous or terrestrial growth—or a wider range in geological time. They are to be found in every part of the world hitherto explored by man, equally within the Arctic Circle as under the Line: they occur at great elevations on the highest mountains of the world, as well as at great depths in the ocean; in boiling or hot springs, and in the ashes ejected from active volcanoes; in running as well as stagnant, brackish or fresh as well as salt, water; on the surface of soil of various kinds; on dung and other decaying organic matters; on lichens, algæ, and other plants. They abound on the Antarctic ice as far south as 78° S. to such an extent as to give colour to the said ice and the associated water. Not infrequently they occur also in the dust of dust-winds, and they may therefore be looked for in that of those which sweep over New Zealand from Australia. Indeed it is difficult to say where members of this cosmopolite family will *not* be discovered.

Practically, Diatoms may be divided into two great groups:—1. the *terrestrial*, including fresh-water forms; and 2. the *marine*.

Exclusively to the former category belong those which I collected in Otago, and which are enumerated in the list hereinbefore given. Members of this group are to be looked for in the mud and scum of ponds, lakes, ditches, lagoons, or marshes—especially where the water is stagnant and overgrown with chlorospermous or confervaceous algæ: or on the surface of rocks or soil over which water constantly trickles, in damp, shady situations—for instance, in ravines by the sides of waterfalls, in the dense moist bush. Their collection is easy; and their siliceous coats render their beautiful structure and characters readily preservable. The scum or the surface of the sand, rock, soil, or water above referred to, has merely to be scraped with a metallic or other spoon, and the collect, after filtration from superfluous water, whether mud, marl, disintegrated rock, confervaceous vegetation or mixture of mosses, hepaticæ and soil, placed in small phials and securely corked. In this way my own small collections in Otago were hurriedly made. In this way collections have been made in all parts of the world and forwarded to the late Dr. Greville, so long our first authority in this beautiful but intricate department of botanical research—who, by this means, was enabled to contribute, in great measure through the pages of this Journal, many valuable and original additions to our knowledge of the Diatomaceæ.

It is certainly not out of place here also to introduce some of Dr. Greville's instructions to myself when about to visit New Zealand; they cannot fail to be as serviceable to, and suitable for others, whether travellers or residents, as they were to me. "The collecting is a very simple affair," says he, "the whole apparatus being a small iron spoon, and a few small, wide-mouthed bottles, half a dozen of which are carried in the pocket.* . . . . You are quite correct with regard to the general habitats of diatoms. In skimming the mud from the banks of streams, select quiet places; and if there are traces of recent floods it would be of no use, as the diatoms would be washed away. Moist, gelatinous, slimy surfaces of rocks (often on vertical precipices and in caves) are very rich in Diatoms, especially when these occur on sea-shore cliffs. Short moss, growing in similar situations, on which water is constantly trickling, is a good trap for diatoms, and a good handful of it might be taken and merely wrapped in paper. . . . . Springs of water, which form little basins lined with mud or sand, almost always contain them. In bogs and morasses, clear spots of water, even a few inches across, are often rich (the mud). . . . Where the margins of ponds or slow streams are lined with *confervæ* or that mixture of slimy vegetation, half cryptogamous, half phænogamous, which so often occurs in such situations, take a handful of it and preserve it *en masse*.† . . . . I am afraid that freshwater *Algæ* may not be in good state; but as to Diatoms *in any sort of mess*, I am not afraid of *them*."‡

I am aware of no contributions whatever towards a knowledge of the *Marine* Diatoms of New Zealand—of its seas and coasts; while I believe this category to be the more interesting, inasmuch as a relationship will probably be proved to exist between living species and those which occur in a fossil state in the various tertiary or post-tertiary, or other calcareous or arenaceous formations of New Zealand—formations that are largely developed in certain localities, and which abound in *Foraminifera* and other minute or microscopic animal organisms [*Protozoa*]. The identity or similarity between existing species and those imbedded in geological deposits, especially of the later ages, has been proved in regard to the Diatomaceæ of various other parts of the world.§ Dr.

* Letter of date, June 6th, 1861.

† Letter of date, June 11th, 1861.

‡ Letter of date, September 15th, 1862.

§ The distribution of fossil forms would appear to be as "extensive in geological, as that of existing species is at the present, time. They range from the Silurian to the Tertiary and Recent epoch; the oldest forms (geo-

Hooker, for instance, mentions that various diatoms obtained by soundings on the Victoria barrier in the antarctic seas at a depth of 300 fathoms (1800 feet) are identical with fossil species occurring in Tripoli slate, and in the Phonolite stones of the Rhine. I have already explained that none of my Otago diatoms were marine. For collection of the latter I had no proper opportunity. Dr. Greville remarks, "Your New Zealand list would have been considerably increased if you had collected *marine* species."* . . . . "On the sea-shore, *small* tufts of seaweed *mixed with zoophytes*, &c., such as are often attached to shells, frequently contain good diatoms."† He also recommends, as we have already seen, the exploration of the slimy surfaces of coast cliffs and caves.

Soundings at sea are also frequently very fertile, even far from land, and at great depths; the collects varying necessarily with the nature of the bottom. In this way, and from such a source, numbers of new and beautiful species have been brought to light by Dr. Roberts, of Sydney,‡ viz., species which inhabit the sea bottom of various parts of the great Pacific and Southern Oceans, as well as of parts of the Australian coasts. There is yet another fertile source of marine Diatomaceæ, viz., the stomachs of the various marine animals which feed on them directly or indirectly—their siliceous coats being indestructible by the ordinary processes of digestion in the larger animals (including birds) which prey on the former: and in the guano and excreta of the birds in question. When I was preparing for a circumnavigation excursion in 1861, Dr. Greville called my attention to this subject. "It is not unlikely that in the voyage you may have opportunities of collecting *very* interesting things. *Salpæ*, &c., always contain diatoms (see Wallich's Paper in 'Annals of Natural History,' January, 1860). If you press the small nucleus seen at one end of a *Salpa*, the contents escape, and there are the diatoms. Some *Salpæ* are several inches long, and the nucleus large in proportion. No doubt *many novelties remain to be discovered* in materials collected from marine floating animals."§ Accordingly, solely with a view to the diatoms they might contain, I carefully collected at various points in the course of my circumnavigation—generally far from land (viz., in the middle of the North Atlantic, in the South Atlantic, in the

logically speaking) being identical in some instances with existing species" (Ehrenberg).

* Letter, dated March 5th, 1866.

† Letter, dated June 11th, 1861.

‡ And partly described in this Journal by Dr. Greville.

§ Letter, dated June 11, 1861.

Southern Ocean southward of Cape Horn) all the *Medusæ*, *Physaliæ*, or more minute marine animalcules which it was possible for me to obtain. Further, I removed and preserved, with their contents intact, the stomachs and intestines of a considerable number and variety of *Birds* (*e.g.*, Albatross, various Gulls, Cape Pigeons, Mother Cary's chickens), and *Fish* (*e.g.*, Dolphin, Bonito, Flying Fish) which prey on these or other marine animal organisms. I also collected masses of the "Gulf weed" in the North Atlantic "Sargasso Sea," with the crustacea and other marine animals inhabiting it; besides various other floating *algæ*, with their parasites, met with at a distance from land. The result, in Dr. Greville's hands, so far as concerns the specimens so collected and brought home, was unexpectedly and exceptionally negative.

"The bottles containing matter from the stomach and intestines of fish and birds, &c., were, I am sorry to say, perfect blanks. I examined them very carefully, and could not find a single diatom."* Other collectors may confidently expect, however, to be more fortunate. In one of his last letters to me, Dr. Greville says, "I have good diatoms just received from the stomachs of *Holothuriæ*, Alexandria, and of limpets from South America." †

To sum up. As regards the New Zealand Diatomaceæ, it thus appears, 1. That only a few terrestrial or freshwater forms are yet known; while 2. Marine species and fossil‡ forms

* Letter, dated July 6th, 1863.

† Letter, dated March 5th, 1866.

‡ The only record of *fossil* species with which I am acquainted is that given by the late Dr. Mantell, in a paper on New Zealand Fossils, in the 'Quarterly Journal of the Geological Society of London,' for August, 1850, vol. vi, p. 332, pl. xxix. There seems, however, to be therein a certain confusion of *Diatomaceæ* with what are now regarded as *Desmidiaceæ* and *Foraminifera*. The so-called "Infusorial earth" of Taranaki and Canterbury, referred to by him (which resembles magnesia in appearance, and was actually *exported* at one time as *Native Carbonate of Magnesia!*), was found to consist mainly of species of the following genera of Diatoms:

Eunotia (*E. ocellata*, Ehrb. A British and European existing form, Rabenhorst).

Navicula (*N. librile*, Ehrb., which occurs—also in the fossil state—in North America).

Stauroneis (*S. Zelandica*, Mantell).

Surirella.	*Pyxidicula.*	*Cocconema.*
Synedra.	*Podosira.*	*Coscinodiscus.*
Pinnularia	*Actinocychus.*	*Bacillaria.*
Gomphonema.	*Melosira* (including the old genus *Gallionella*).	

A careful examination by Prof. Rupert Jones of a suite of Tertiary Foraminiferous limestones, sandstones, and mudstones, collected by me in the vicinity of Dunedin, Otago, curiously enough proved negative in its results —no Diatomaceæ whatever having been discovered.

are altogether or almost unknown. The most promising lines of research for the local botanist—in addition to the mere discovery of species—are the inter-relations of the existing to the fossil flora, and of New Zealand forms to those of Britain, Australia, and other parts of the world. The botanist who devotes himself to their examination and description will doubtless find New Zealand Diatoms possessed of that common peculiarity or attribute of all New Zealand plants—as well as of the lower Cryptogams wherever they occur—variability or inconstancy of character; and it will try severely both his patience and skill to define those groups of individuals which are known to systematists as "species"—groups which appear to me in many genera at least both of Cryptogams and Phænogams—to have no real existence in nature. In all probability the large additions which must remain to be made to the New Zealand Diatomaceæ will contain few new species or varieties in proportion to those which are already known as cosmopolite, or widely diffused European or British forms, whether living or fossil.

II. *Desmidiaceæ.*

Of this large and most interesting family as it is developed or represented in New Zealand we as yet know nothing; no species having been, so far as I am aware, hitherto either collected or described. So little is known of this family beyond Europe, where they appear to decrease in number from north to south, that it is impossible to predict what numbers or kinds—what genera or species—may be found in New Zealand. But the very obscurity which surrounds our knowledge of their natural history and geographical distribution should be a stimulus to their careful study by the local botanist. With a few exceptions, which occur in brackish water, but are not peculiar thereto, these beautiful though minute organisms occur in *fresh* water. They are supposed to assist in the clarification or purification of the water in which they occur, and to constitute the food of various minute aquatic animalcules. They are to be looked for, it would appear, if we are to be guided by the character of their usual habitats in Europe, in clear, still water, chiefly in the vicinity of *peat*. In *limestone* countries or districts the higher forms are rare. Several species are *fossil;* and, like the fossil Diatomaceæ, these fossil forms appear either identical with or closely allied to existing species.

III. *Palmellaceæ*,

generally speaking, are to be looked for as the first forms of vegetation which coat with green or otherwise-coloured moulds or stains the damp-shaded surfaces of rock—or of stone or wooden constructions of all kinds—coatings which are frequently associated and apt to be confounded with, from their resemblance to, various conditions of certain groups of the lower *Lichens* and *Fungi*. To them (*Palmellaceæ*) also are probably due some at least of the "coloured rains" described by travellers in various countries. This class of organisms is so common that it is likely to be overlooked by all but the microscopist, to whom it will furnish many interesting additions to the cryptogamic flora of New Zealand: though the proportion of novelties as in the Diatomaceæ may not be great, while the number of cosmopolite or widely diffused forms may be considerable.*

It must be evident, then, that in the department of the *Protophyta* alone very extensive and most important additions may be expected to be made by the labours of specialists—

I. To the catalogue of New Zealand species, recent and fossil: as well as to our

II. Knowledge of

a. The variations of these species.

b. Their geographical distribution; and

c. The inter-relations of living and fossil forms.

In particular, species of *Palmella* and *Protococcus* may be looked for. I found *Palmella cruenta*, Ag., in Otago.† At home this species is extremely common, and frequently very beautiful, occurring about the damp bases of the walls of buildings, giving the appearance as if some red fluid had been recently poured over their surface. In similar habitats it is likely to be found in New Zealand. Forms allied to the fungus-like *P. prodigiosa*, which spreads over meat, boiled vegetables, and other organic substances, with great rapidity, spotting them as with blood-stains, may be expected. Species of *Protococcus* allied to *P. nivalis* are likely to occur in New Zealand. In both the genera in question, and in their allies, the local botanist will doubtless experience much difficulty in determining what are to be considered forms or varieties —stages or states of growth—and what species or types.

* Compare remarks on *Algæ*, in paper on 'New or rare Cryptogams from Otago, New Zealand," 'Trans. Botan. Society of Edin.,' vol. viii, p. 283.

† "On New or Rare Cryptogams from Otago, New Zealand," 'Trans. Botan. Society of Edin.' vol. viii, p. 284.

On some New *and* Rare Diatomaceæ *from the* West Coast of Ireland. By Rev. Eugene O'Meara, A.M., Rector of Newcastle Lyons, Hazlehatch.

The matter supplied to me, of which only a small portion has as yet been searched, was raised in August last, as Dr. E. Perceval Wright informed me, from depths varying from ten to thirty fathoms, off the Islands of Arran, in Galway Bay. Taking into account the number and rarity of the species found in it, this gathering may be regarded as one of the most interesting ever made, certainly the most interesting ever made in Ireland.

Some of the common marine species are met with; for instance—

Actinoptychus undulatus.
Amphitetras antediluviana var. β.
Biddulphia aurita.
Coscinodiscus radiatus.
,, *minor.*
Campylodiscus Ralfsii.
Eupodiscus crassus.
Grammatophora marina.
,, *serpentina.*
,, *maculata.*
Isthmia enervis.
Navicula didyma.
Nitzchia plana.
,, *sigma.*
Pleurosigma decorum.
,, *formosum.*
,, *quadratum.*
,, *strigosum.*
Rhabdonema arcuatum.
Stauroneis pulchella.
,, ,, var. β.
Synedra Gallionii.
Tryblionella marginata.

It is a remarkable fact that the above-named species are relatively few, and the forms belonging to them, generally speaking, are not of frequent occurrence.

Besides the common forms just enumerated, I have found a large number of the rarer species described by Donkin, Gregory, Greville, and Roper, investigators in this department of natural science whose discoveries have been made known since the publication of Smyth's 'Synopsis of British Diotamaceæ,' namely—

Amphiprora maxima, Greg.
Amphora sulcata, Roper.
,, *robusta*, Greg.
,, *obtusa*, Greg.
,, *arenaria*, Donkin.
Cocconeis pinnata, Greg.
,, *pseudomarginata*, Greg.
,, *Grantiana*, Grev.
,, *scutellum*, var. β, Roper.

Campylodiscus simulans, Greg.
Coscinodiscus concavus, Greg.
" *nitidus*, Greg.
Navicula Hennedyi, Greg.
" *æstiva*, Donkin.
" *forcipata*, Grev.
" *hyalina*, Donkin.
" *nitida*, Greg.
" *clavata*, Greg.
" *lineata*, Donkin.
" *pretexta*, Greg.
" *maxima*, Greg.
Pinnularia pandura, var. *elongata*, Greg.
" *semiplena*, Grev.

As regards the forms included in the foregoing list, I have no remark to make beyond the record of their occurrence, except in the case of *Campylodiscus simulans* and *Coscinodiscus nitidus*. Several frustules of *Campylodiscus simulans* have occurred in the gathering, and in many instances I have observed the same peculiarity which Dr. Gregory noticed in the frustules of *Campylodiscus bicruciatus*, namely, that the opposite valves are frequently placed at right angles to each other.

Coscinodiscus nitidus is figured and described by Dr. Gregory in his paper on "New Forms of Diatomaceæ found in the Frith of Clyde," and supposed by him to be the same as a form previously figured from an imperfect specimen found in the Glenshira Sand. In the paper on the Clyde forms Dr. Gregory, having described *Coscinodiscus nitidus*, proceeds to say, "This pretty disc was figured without a name from an imperfect specimen in my last paper on the Glenshira Sand. ('Trans. Mic. Soc.' Vol. V, Pl. I, fig. 50.) Having found it tolerably frequent in Lamlash Bay, I now figure a perfect example, which, provisionally, I refer to Coscinodiscus."

This form found in Lamlash Bay occurs frequently in Dr. Wright's gathering, and with equal frequency is another form very like it at first inspection, but which, on closer examination, presents distinctive characters. This latter appears to me identical with that figured from an imperfect specimen in the paper on the Glenshira Sand. A careful comparison of many frustules seems to confirm this opinion. The Clyde form is accurately described as follows:—"Surface of the disc marked with distant and irregularly radiate lines of rather large, round, distant cells or granules. The rays are distinctly marked towards the margin, but somewhat confused towards

the centre. Puncta or granules larger towards the centre than at the margin." In the other form the rays are distinctly marked through the entire length, some of them reaching the centre, others terminating at some distance from it, and others extending but a short distance from the margin. The granules forming the rays are considerably smaller than those of the other species referred to, and the central ones are scarcely larger than those at the margin.

For these reasons I consider the two forms should be regarded as distinct species, and suggest that henceforth the name *Coscinodiscus Gregorianus* should be given to the form found by Dr. Gregory in the Glenshira Sand.

I now proceed to mention a fact deserving of special attention, namely, this—that Tessella Interrupta, Eupleuria Pulchella, and forms belonging to the genera Hyalodiscus and Omphalopelta, have been met with in this collection. These species have been discovered in distant parts of the world, but, so far as I can learn, have not hitherto found a place in the list of British diatoms.

But the number of forms which, so far as I have been able to ascertain from the sources of information available to me, have not been hitherto described, constitutes the most interesting feature of this valuable collection. Some of these I shall hold over for further examination, and now submit to your consideration a few of these new forms, with their descriptive characters.

Navicula Hibernica, n. sp., O'M., Pl. V, fig. 1.—Broadly elliptical; length ·0041, breadth ·0024; striæ very fine, confined to a narrow marginal band; parallel to the median line there is a broad band without striæ, linear, interrupted at the central nodule, constricted towards the ends, and rounded; the central portion of the valve is granulated. This pretty form is closely allied to *Navicula indica*, Grev., but has not the mammiform apices nor the lyrate blank space of that beautiful species.

Navicula pellucida, n. sp., O'M., fig. 2.—Length ·0036, breadth ·0013; constricted; striæ very fine, confined to a very narrow marginal band, shorter towards the ends and the central constriction; the inner part of the valve smooth, pellucid; at either side of the median line divided into two compartments by a longitudinal curved line; in front view constricted, marked at the centre and ends by bead-like nodules.

Navicula denticulata, n. sp., O'M., fig. 3.—Length of valve ·0034, breadth ·0013; deeply constricted; striæ costate rather than moniliform, marginal, with a narrow, striate,

longitudinal band close to the median line; the interspaces blank. Properly this form belongs to the Pinnulariæ; but although the reasons assigned for merging the latter family in the Naviculæ seem scarcely satisfactory, I feel disposed to fall in with the tendency in this direction when the form presents the general characteristics of the Naviculæ. This species bears a striking resemblance to *Navicula Egyptiaca*, described by the late lamented Dr. Greville in the last number of the 'Microscopical Journal.' *Navicula denticulata*, however, is distinguished from that just referred to by the following characters:—It is much shorter and broader, the marginal striæ are longer, the central striæ are nearer to the median line, and continuous instead of being interrupted towards the central nodule as in the case of *Navicula Egyptiaca*.

Navicula Wrightii, n. sp., O'M., fig. 4.—Valves broadly elliptical; length ·0041, breadth ·0024; striæ fine, marginal; there is a broad band at either side of the median line, linear, interrupted towards the central nodule, slightly constricted as it approaches the marginal band of striæ, and then expanding towards the apex, which is mammiform. This longitudinal band is destitute of striæ. On first inspection this form is liable to be mistaken for *Navicula Hennedyi*, but it is soon distinguished from it, not only by its mammiform apices and the spathulate extremities of the longitudinal median band, but also by the fact that in the present species this band is blank, while in *Navicula Hennedyi* it is striate. A variety of this species is described in fig. 4 B, much smaller than the other, and having the sides nearly parallel. Length ·0030, breadth ·0014.

Navicula amphoroides, n. sp., O'M., fig. 5.—Valve elliptical, narrow; length ·0032, breadth ·0014. In this form the central nodule is depressed, and the median line waved; striæ moniliform, in the middle approaching the central nodule, and becoming gradually shorter towards the extremities.

Pinnularia Arraniensis, n. sp., O'M., fig. 6.—Valve broadly elliptical; length ·0030, breadth ·0017; striæ coarse, distinctly costate, not reaching the median line. In some aspects this form resembles *Navicula Smithii* and *Navicula æstiva*, Donk., but differs from the former by its distinctly costate striæ, and from the latter by the coarseness of its striæ, as also by the fact that it is much broader in proportion to its length than *N. æstiva*.

Pinnularia divaricata, n. sp., O'M., fig. 7.—Broadly elliptical, costate; length ·0058, breadth ·0035; the ends slightly

produced and rounded; the central space large, with an outline resembling the vertebra of a fish. Through this space there runs a well-marked median line, very fine at the outward extremity, and becoming broader towards the centre, at some little distance from which it terminates in a small bulb. The costæ are arranged concentrically with the apex at either end for about one third the length of the frustule, while those in the intermediate portion spring from the margin of the central nodule. The central costa runs at right angles with the longitudinal axis, and those at either side radiate towards it more and more as the distance from this line increases. The costæ in the central part of the valve are furcate. In some the furcation appears near the outer margin of the valve, in others near the central nodule; some few are bifurcate. It is worthy of notice that in some aspects the costæ appear as if they were slightly notched by longitudinal lines, which, though they produce a furrow, do not sink so deeply as to give a moniliform character to the sculpture of the valve.

Pinnularia constricta, n. sp., O'M., fig. 8.—Valve elliptical; length ·0044, breadth ·0014; central nodule depressed; costæ distant, nearly reaching the median line, except at the central nodule; in front view constricted, linear.

Pinnularia forficula, n. sp., O'M., fig. 9.—Valve broadly elliptical; length ·0021, breadth ·0014. In the middle is a blank space, curved, constricted at the central nodule, and towards the apices from each side converging to a point. The striæ are distinctly costate, and longer at the middle than towards the apex. This form in its outline closely resembles *Navicula Smithii*, var. δ, *suborbicularis*, described by Gregory in his paper on the Diatomaceæ of the Clyde, but is distinguished from it by its costate striæ.

Surirella pulcherrima, n. sp., O'M., fig. 10.—Length ·0046, breadth ·0037; broadly elliptical, ends symmetrical and nearly lanceolate; the border narrow; the central area wide, elliptico-lanceolate, and striate at the margin; canaliculi about fifteen on each side, at first narrow, then expanding towards the outward margin, the narrow part short and robust; alæ conspicuous.

Surirella gracilis, n. sp., O'M., fig. 11.—Length ·0055, breadth ·0037; ends symmetrical and broadly rounded; canaliculi about twenty-four on either side, slightly radiate, narrow at first, and then expanding towards the outward margin, the narrow portion long, the expanded part first rounded and at a short distance from the junction slightly constricted, and gradually enlarging till it approaches the margin, where it terminates in a rounded end, separated from

the next one by a very small space; outer margin finely striate, as is also the margin of the central area, which is elliptical; alæ not conspicuous.

REMARKS *on the* PUBLICATION *of* NEW GENERA *and* SPECIES *from* INSUFFICIENT MATERIAL. By MR. F. KITTON.

(Read at the Quekett Microscopical Club, February 22nd, 1867.)

I HAVE the honour this evening of calling your attention to the growing desire of students of natural history, and more particularly of microscopical observers, for the discovery and description of new genera and species, in consequence of which desire our floras and faunas are encumbered with names and synomyms, two thirds of which have no claim to be there at all. This evil has been, and still is, most virulent amongst the students of the Diatomaceæ, probably because the Diatomaceæ have attracted the attention of a larger number of microscopic observers than any other class of minute organisms. Professor Ehrenberg unfortunately adopted the plan of constituting new genera and species from mere fragments; and however allowable it may be for geologists to make genera and species of the fragmentary remains of the organisms of past epochs, it is surely not desirable that recent forms, occurring as fragments only, or even in small quantities, should be made into new species.

Ehrenberg, in his 'Microgeologie,' figures a genus which he names Symbolophora. One species he represents like an Actinoptychus with a triangular umbilicus; the other is a fragment, but showing a similar triangular centre. I have examined a great number of slides prepared from materials obtained from similar sources as Ehrenberg's, but have never succeeded in obtaining a specimen of his perfect figure; the fragment I suppose to be a portion of *Triceratium Marylandicum*. This species has an irregularly triangular centre. A good figure is given in Mr. Brightwell's paper published in the 'Journal of Microscopical Science,' Vol. IV, Pl. XVII, fig. 17. It sometimes occurs with the angles acute instead of rounded.

Ehrenberg's genera Actinoptychus, Heliopelta, and Omphalopelta, each of which contains a vast number of species, might all, with a little enlargement of the generic characters,

be merged into one genus containing some four or five species.

Another instance of a supposed new species proving to be otherwise may be mentioned, viz. *Actinocyclus triradiatus*; this the author afterwards found to be only a secondary plate of *Actinocyclus undulatus*, Sm., *Actinoptychus senarius* of Ehr. (By some unaccountable oversight of Professor Smith's, he has confounded Ehrenberg's Actinocyclus with his Actinoptychus.) The genus Actinoptychus, Ehr., contains the form with undulate valves, like the *Actinocyclus undulatus*, Sm. Actinocyclus, Ehr., contains the discs with radiating series of granules, and a pseudo-nodule, like Smith's *Eupodiscus Ralfsii*, *sparsus*, &c.)

A similar case occurred to myself. A friend sent me a slide of the so-called Bermuda earth (a Miocene deposit from Bermuda Hundred, New Nottingham, U.S.), in which he had marked a new species of Heliopelta; this I found on examination to be a secondary plate of *Heliopelta Metii*. It does not appear to be generally known that the valves of many species of Diatomaceæ are composed of thin, siliceous plates, in some cases similar, in others dissimilar. In Heliopelta the secondary plate is finely striate, similar to a Pleurosigma; in *Actinoptychus undulatus* it is irregularly punctate. The valves of *Actinocyclus* (*Actinoptychus*) *triangulatus*, Brightwell, in the 'Jour. Mic. Sci.,' Vol. VIII, Pl. V, fig. 2, will sometimes separate into three similar plates or lacunæ; the drawings 2*a* and 2*b*, are not intended, as there stated, to represent a frustule undergoing subdivision, but the plates *in sitú*. The same phenomenon occurs in the valves of *Actinocyclus Ralfsii*; the secondary plates are hyaline, and marked with very faint radiating granules, like faint impressions of the primary plate. I adduce these examples as illustrating the danger of instituting new genera and species from observations made on single specimens, and these, perhaps, from fossil deposits or dredgings. No new species should be published until a copious gathering has been obtained, and the form studied in a living state if possible.

Habitat has also much to do with the appearance of the diatom. A species in an unfavorable locality will not secrete the same amount of silex as the same species in a more favorable locality; the markings are much fainter, and the valves thinner; self division goes on, and every new-formed frustule is less strongly developed than its predecessor, and thus a gathering appears to contain several new species.

Again, an abnormal frustule may be formed, and if self-division occurs the departure from the original will be

repeated, and only when reproduction by means of conjugation takes place will the normal form be produced. Although diatoms multiply enormously by self-division, yet this has its limits—first, by the exhaustion of the spermatic force; and, secondly, by the continued decrease in size of the frustule. It must be remembered that each successive frustule is formed within the parent, and the new-formed frustule does not increase in size, although it goes on secreting a thicker siliceous valve. I have some specimens of *Surirella ovalis* from Queen's Park, Edinburgh, in which many of the valves have a central constriction; this arose from the abnormal state of the parent frustule. If this form had occurred but sparingly, and unmixed with the common form—one or two in a slide—it would probably have been described as a new species. Contour, that is to say, the outline of a valve, has very little generic or specific value. I have *Triceratium favus* from Sierra Leone of a semicircular form; *Amphitetras antediluviana* from Joppa triangular. *Triceratium orbiculatum* is sometimes so nearly circular that it might be taken for a Eupodiscus. *Surirella fastuosa* is frequently so truly orbicular that it may readily be mistaken for a Campylodiscus. Stictodiscus often seems to merge into a small Arachnodiscus. *Pleurosigma rigidum* occurs on the French coast and the Mediterranean without the sigmoid flexure, and the median line central, resembling in outline a Stauroneis.

It would be occupying too much of your time if I were to enumerate all the species which gradually assume the appearance of other and supposed distinct species. I have, I trust, sufficiently proved the necessity of the greatest caution in publishing supposed new genera and species; above all, avoid doing so from sparse material or unique specimens; rest assured that all recent diatoms will some time or other occur copiously, and then the range of variation will, to some extent, be seen. It would be far better to throw unique specimens into the fire than add an imperfectly described form to the already overburdened floras. It must also be remembered that a generic character taken from a single specimen can only belong to that specimen, and must be too limited to admit other specimens, varying however slightly, to be relegated to it. When a supposed new form occurs to an observer the better plan is to endeavour to discover the points of resemblance to already described forms than those where it departs from them, and by pursuing this plan more real benefit will be rendered to future observers than the addition of fifty new species.

An anecdote was once related to me of a great botanist (I think Robert Brown) who, being shown several so-called species of exotic plants, remarked that he had seen several of the supposed species united in one plant in their native habitat.

On Two New Species *in* Saprolegnieæ, *referable respectively to the genus* Saprolegnia (Nees v. Esenb.) *and* Achyla (Nees v. Esenb.). By William Archer.

Even at the risk of being, perhaps, considered as somewhat premature in coming forward to describe two new species in the family Saprolegnieæ, without being quite satisfied as to the particular genus to which I assume, from certain data afforded, that they each respectively belong, I still venture to do so, inasmuch as the reproductive parts offer abundant characters to establish them as, indeed, distinct, undescribed species, although their generic position may remain uncertain.

As is now known, the generic characters in this family seem to depend on the mode of formation and evolution of the zoospores, and the specific characters on the conditions of the sexually developed reproductive organization, and on the special figure of the oogonia. Hence, unless one be successful in finding one of these plants in a sufficiently early condition to gain a view of the formation of the zoospores, which ordinarily precedes the true fructification, its generic position cannot be definitely predicated. On the other hand, if one see the zoospores only, and thus establish the genus, but fail to get a view of the conditions of the other type of fructification, the species to which any particular plant belongs must remain undetermined. So far as more modern research goes, and so far as I have myself had the fortune to find any of these plants in a fertile state, it appears to me that here there exist various forms which, at least, seem to maintain an identity of conditions, and individually to present the same recurring characters. On this point, however, I dare not as yet speak definitively. The extended experience of various observers of these productions in their different stages may be requisite to solve the question. All we can as yet go upon is experience hitherto. The possibility that some of these forms may have stages of development which take place out of water, does not seem to speak against their individuality. The views of some authors, if hereafter borne

out by future observation, that some of these run through certain early stages upon house-flies, having, as is stated, actually commenced their growth in their blood, and that they perfect their development as Saprolegnieæ only on falling accidentally into water, would merely show that here an "alternation of generation" may occur not less surprising than that which has been already established in other departments. The same plants—forms which give rise to an evidently fertilised oospore—again and again present themselves. These, I should hold, must have descended either directly or through whatever may be the characteristic intervening stages from a similar pre-existent plant. This would, at least, appear to me a more reasonable supposition than that any number of given germs evolved from the same parent form should, some of them, develop into one definite form, with a certain set of conditions, and that others should develop into some other equally definite forms with certain other sets of conditions.

Hence, I think, when we meet with certain combinations of conditions, and certain specialities in figure, of the reproductive organs, not shown by known forms, we are justified in looking upon such as distinct species. The present forms, then, in themselves quite distinct, seem to demand a record.

When I met with the first form to which I would draw attention (Plate VI, fig. 1), I was momentarily under the impression that I hade ncountered a *gynandrosporous* type of fructification in the Saprolegnieæ. The existence of this type one might, *à priori*, be disposed to believe likely, even were it not, indeed, all but directly proved by Pringsheim's observations.* But a closer inspection speedily proves, not only that there is here merely a superficial resemblance to the gynandrosporous type, but also, as will be seen, that the plant is truly monœcious, though presenting what seems to be a sufficiently noteworthy modification of the structure in other described monœcious species.

Beyond doubt, the present plant seems to be a very well-marked new species; but, as before mentioned, from not seeing the zoospore-condition, its generic location remains uncertain. However, I should be disposed to regard it as most probable that this plant, should it be again met with, may be found to appertain to the genus Saprolegnia. The reason for leaning to this genus is that, in one instance, in the mass made by the plant, three seeming sporangia evacuated by zoospores, one *within* the other, each showing a ter-

* 'Jahrbücher für wissenchaftliche Botanik,' Band ii, p. 213, "Nachträge zur Morphologie der Saprolegnien."

minal opening, were observed—so far characteristic of Saprolegnia.

Setting aside, however, the generic characters, this plant is specifically characterised (I believe from every other Saprolegniaceous plant yet described) by its true fruit, in the following manner:

Saprolegnia androgyna, sp. nov. Fig. 1.

Plant monœcious; oogonia large, barrel-shaped or elliptic, mostly in an uninterrupted terminal series, though occasionally interstitial; the terminal oogonium the oldest in a series, the oogonia thus showing gradually different degrees of development down to the basal one, which is the youngest; the lateral male branches (Nebenäste, Pringsheim), with the exception of those fertilising the lowest oogonium of a series, are not derived either from the principal stem of the plant or from any neighbouring portion of the general plant, but these are given off from the oogonium itself, which is next immediately beneath the oogonium which is fertilised by them, and so on down to the lowest or basal oogonium of a series, to which last are given off lateral male branchlets from the original filament or stem immediately thereunder. The tube or cavity of each lateral male branchlet becomes shut off by a septum formed a short distance above its origin, the portion of the contents above the septum being developed into the male element—that portion of the contents below the septum retaining its characters, and being returned back into the oogonium, whence it originated, in time to become employed, with the remainder of the contents, in the formation of the oospores. Oospores large, about $\frac{1}{830}$th of an inch in diameter, mostly numerous, but very variable in number, sometimes, though rarely, as few as even one. They occasionally exhibit what appears to be a roundish excentric vacuole. The whole plant large and coarse as compared with other described forms in this family.

If thus, for sake of illustration, we call the upper (mostly terminal) oogonium A, that beneath it B, that beneath the latter C, and so on down, let us suppose, to G; then oogonium A is fertilised by the lateral male branchlets emanating from and in direct continuation with B; the oogonium B is fertilised by the lateral male branchlets, in the same way, emanating from C, and so on down to F, which is fertilised by the male branchlets emanating from G; but G is itself fertilised by the lateral male branchlets emanating from the supporting stem, for G has no oogonium beneath. So, of the whole chain of oogonia, the oospores in each, the lowest one excepted, are fertilised by the male elements derived from

the branchlet given off by the oogonium immediately below. The terminal oogonium does not, of course, give off any male branchlets; they would have no duty to do, no function to perform. The contents of the oogonia, which in their turn successively give off lateral male branchlets, do not become formed into oospores until the septa, cutting off the upper portion to become the male element, are duly formed in the branchlets, nor until the granular contents beneath such septa become returned back into the oogonium in time to participate with the remainder of the contents in the formation of the oospores. As in other Saprolegnieæ, the whole contents of each oogonium become used up to form the oospores, whatever may be their number. The male branchlets seem to penetrate the wall of the oogonium at any accidental point.

Thus, this species, whilst it agrees with other monœcious forms in the character implied, differs from them in presenting so curious an example of confusion of parts with a maintenance of clear distinctness of function—a male-female or female-male, yet male and female elements distinct *per se*. In this character, then, it differs from every Saprolegniaceous form described, as well as (with another form, to the figures of which I shall presently draw attention) in the oogonia being formed, not solitary and terminating lateral branches, but in a usually uninterrupted series, mostly terminating a filament, but sometimes produced at some point along its length.

On looking at this plant at first sight, from what has been said, it will not, perhaps, appear surprising that it should have been momentarily taken as a gynandrosporous form—the lateral male branchlets emanating from each oogonium, and reaching up to the oogonium immediately above, looking not unlike dwarf male plants of separate origin seated on the outer surface of each oogonium. But a closer examination reveals their true nature, and proves that these are in direct continuation with the oogonium giving them off, like the thumb to a glove. But casually viewed, however, there is no doubt some amount of resemblance to the gynandrosporous type, and I even looked for some time for the male element in another direction, trying to find the mother-cells of androspores; but this was only when I had as yet seen but a single specimen of the fruit, which did not show its true structure as clearly as the numerous ones which afterwards presented themselves.

The second form to which I venture to direct attention is a diœcious plant (figs. 2—6). Unfortunately, however, as in the previous instance, I did not meet with it in a stage

sufficiently early to see the evolution of the zoospores, and thus to determine the genus. Still, combining two indications furnished from other sources, presently to be mentioned, the evidence seems sufficiently strong to point to the genus Achlya as the proper location of this species.

I have mentioned that this form is diœcious, but I had the good fortune to meet with the empty mother-cells only of the spermatozoids. Their structure and mode of development, however, agreed so completely with that part of the fructification in *Achlya dioica,* as figured by Pringsheim, that there is no need here to give a drawing.* A terminal portion of one of the tubular filaments of which the plant is composed was divided by transverse septa into several cavities, two or three times longer than broad; these cavities were densely filled by empty globular hyaline coats, which had evidently been evacuated by the contents. The only difference from Pringsheim's figure consisted in these special-mother-cells being somewhat smaller and more numerous.

Now, whereas in *Achlya dioica* (Pringsh.) the spermatozoids are produced by unskinning from a special mother-cell, as are also the zoospores, so also I think we may feel justified in assuming from analogy, inasmuch as the spermatozoids in the present instance are formed by unskinning from a special mother-cell, that likewise here too are the zoospores. If so, this plant would fall under the genus Achlya.

Another indication pointing to the genus Achlya is as follows:

In this new species, not infrequently just under a terminal oogonium, the main filament gives off one or two or three lateral branches in a kind of proliferous manner, and these are usually of considerably less diameter than that of the supporting stem. These, at first sight, might be supposed to look not unlike what might be intended to become lateral male branchlets (fig. 5), sufficiently puzzling after one has previously found that the species is a diœcious one. But when we notice that the oospores are here fully formed, and yet that this lateral branch still retains its contents and is not in contact with the oogonium, such a mistake is prevented. Such a form as that drawn in fig. 6 at once, however, explains the former case. Here we see the ends of these become inflated, densely filled with contents, and shut off as oogonia. In these secondary oogonia I never noticed more than one oospore, although the first-formed oogonia might contain perhaps as many as eight or ten, though ordinarily fewer.

Now, this proliferous manner of growth is the second cir-

* 'Jahrbücher für wiss. Bot.,' Band ii, t. xxiii, fig. 2.

cumstance which points to the genus Achlya. In that genus the zoospores, besides being the products of a number of special mother-cells (not, as in Saprolegnia, primordial cells) formed from the contents of the sporangium, the sporangia themselves are, moreover, produced, one or more generations after the first, by being given off laterally at the base of the first (not terminal as in Saprolegnia, and the new sporangium being pushed up within its now empty predecessor). Now, may not this tendency, seeming inherent in Achlya, to put forth fresh growth laterally, when about to form new sporangia, be again evinced when about to put forth new oogonia? May not this kind of innovation, so to speak, be characteristic of the genus Achlya, so far as it is worth?

The following may serve as a description of this plant:

Achlya cornuta, sp. nov. Figs. 2—6.

Plant diœcious; oogonia large, mostly terminal, often in an uninterrupted series, the outer wall drawn out into numerous horn-like extensions of varying and often considerable length, sometimes bifid; the apex of the terminal one drawn out generally very long, and occasionally the supporting filament or stem giving off lateral branches by a kind of proliferous growth, each of which eventually terminates in an oogonium of similar character, but usually of smaller size; oospores large, one or several in an oogonium; mother-cells of spermatozoids as in *Achlya dioica*. I have not been able to see any openings in the wall of the oogonium; they must doubtless exist, but the densely arranged cornua render the examination with this view very difficult. De Bary himself, in his *Aphanomyces stellatus*, found the same difficulty from the same cause. The uppermost oogonium is the oldest or first formed, the lowest the youngest or last formed, in the series.

Here, as is seen, the oogonia occur in a continuous series, several being in succession separated merely by a septum, or they may be few or even solitary; they mostly terminate a filament, and rarely occur along its length. In this respect they differ, so far as I know, from those of other Saprolegnieæ recorded, except *S. androgyna* above described. But, if I am right, this form not only falls under a distinct genus from that just described above, but, even if the evidence were in favour of their belonging to one genus, they are abundantly specifically distinct in that the present plant is diœcious, the former monœcious, and that on a seemingly novel plan. Moreover, *A. cornuta* is abundantly distinct, owing to the remarkable horn-like extensions, numerous and often long, and occasionally bifid, which are presented by this form; on

one occasion a curious depressed and equally lobed form of these cornua presented itself (fig. 4, the second oogonium to the right near the base). This reminds one somewhat of the form of the oogonium in *Œdogonium Itzigsohnii* (de Bary); and to those who have seen that plant in fructification the comparison will at once call to mind the figure of this peculiar lobed extension. I, of course, mean to institute no further comparison between them. This new species, too, seems thus quite distinct from *Achlya dioica* by the character mentioned. *A. dioica* has globular oogonia, destitute of cornua, and are seemingly always solitary—in fact, so far as they go, quite like those of *Saprolegnia monoica*, except that they are smaller. The projecting cornua call to mind the similar but smaller ones of *Aphanomyces stellatus* (de Bary);* but setting aside the evidence of this plant belonging to the genus Achlya, all the species of Aphanomyces described are monœcious, that is, furnished with lateral male branchlets emanating from another part of the filament. As regards *Saprolegnia asterophora* (de Bary),† even setting aside, as in the previous comparisons, the evidence as to the generic location of this plant in Achlya, it is again well distinguished by being diœcious, whilst *Saprolegnia asterophora* is, like *Aphanomyces stellatus*, monœcious. It is, besides, different from all these forms mentioned by its larger and coarser size, as well as often producing several oospores in the oogonia, whilst all the species referred to very rarely produce more than a single oospore.

NOTE *on the* BLOOD-CORPUSCLES *of the* TWO-TOED SLOTH, CHOLŒPUS DIDACTYLUS. By PROFESSOR ROLLESTON.

MR. H. N. MOSELEY, of Exeter College, called my attention a few days ago to the appearance of nucleation which a slide of the dried blood-corpuscles of the Two-toed Sloth, *Cholœpus didactylus*, presented under a quarter-of-an-inch object-glass of Powell and Lealand's. I had a short time before met with a statement in the recently published second part of Dr. Kühne's 'Lehrbuch der Physiologischen Chemie,' p. 195,‡ to the effect that only some mammals, the sloth

* 'Jahrbücher für wiss. Bot.,' Bd. ii, p. 178, t. xix, 1—13.

† Loc. cit., p. 189, t. xx, 25—27.

‡ 'Lehrbuch der Physiologischen Chemie,' von Dr. W. Kühne, p. 195 :—

and the camel, possessed nucleated blood-corpuscles. And this coincidence determined me to use such means as we had at our disposal for settling a point as to which all recent authorities were, as far as my knowledge went, opposed to Dr. Kühne.

The employment of a twelfth-of-an-inch object-glass by the same makers has convinced Mr. Moseley and myself that, though a certain number of the dried blood-corpuscles of the sloth do contain one or more nuclei more or less roughly hewn, and irregularly and eccentrically placed, still the immense majority of them possess the non-nucleated character ordinarily assigned to the mammalian red blood-cell. The large size of the blood-cells of the two-toed sloth, the largest next to those of the elephant put on record amongst mammalian blood-cells by * Mr. Gulliver, may, in more ways than one, have rendered an examination of them by a low power amenable to fallacy, and recourse to those of a higher power necessary. In the smaller corpuscles of the camel neither power enabled us to detect the presence of nuclei in the coloured blood-cells.

Bearing in mind Nasse's observation † as to the comparative frequency of the presence of a large colourless nucleus, or, in the place of it, of an area of fainter coloration, in the coloured blood-cells of the pregnant human subject, and also of the pregnant bitch, I examined the blood from the uterine veins of a cow which had been killed, in ignorance, as I was told, towards the end of the period of gestation. But I was unable to discover any nucleated red corpuscles in the blood from this source.

It is well known that nucleated red blood-cells have been observed in the blood of the human subject,‡ of the horse,§ of the elephant,|| of the paco,¶ and of the sheep ;** but it should also be recollected that round coloured blood-cells, so

"Gewiss ist es höchst auffallend dass nur das Blut der Saugethiere sich durch den Mangel dieses Bestandtheils (des Kerns) auszeichnet, dass nur einzelne (Kameel, Faulthier) unter ihnen kernhaltige Blutkörperchen besitzen."

* Hewson's Works, p. 238.

† Wagner's 'Handwörterbuch,' i, 90, cit. M.-Edwards, 'Leçons,' i, p. 66.

‡ Nasse, l. c.; Busk, 'Quart. Journ. Mic. Soc.,' 1852; translation of Kölliker's 'Handbook,' ii, p. 348, 1854.

§ Wharton Jones, 'Phil. Trans.' for 1846, p. 73.

|| Ibid., and Schulze, 'Muller's Archiv,' 1839, p. 252; but see Cotti, 'Zeitschrift für Wiss. Zool.,' vol. v, cit. Kölliker, 'Mikro. Anat.,' ii, 2, 583.

¶ Wharton Jones, l. c.

** Ibid.

small as to resemble very closely the normal mammalian blood, may be found very constantly in the blood of certain ovipara.* Here, as in so many other cases, the morphological value of a structural arrangement depends, not upon an invariable presence or an invariable absence, but upon the constancy of its quantitative preponderance. And upon this principle, whatever other affinities to the sauroids the sloth may be supposed to possess, the microscopy of its blood cannot be held to point in that direction. That the red blood-cell—the carrier of oxygen, and, probably enough, the distributor of heat † generated in the body—should present such different structural characters in the two classes, *Aves* and *Mammalia,* which are both alike warm-blooded, is a fact of the greater morphological importance for that it is physiologically so hard to understand. From the purely anatomical point of view it may be allowable to suggest that the enormous relative preponderance of the lymphatic and lacteal gland system in the mammalia may account for the almost exclusive presence in their blood of the small non-nucleated red blood-cell.

Since writing the above I have, through the kindness of T. J. Moore Esq., of the Liverpool Museum, had the opportunity of examining the blood of an elephant, *Elephas Indicus,* which had died a week previously in Mr. Manders' Menagerie.

In this blood very many nucleated red blood-cells were visible; but in all observed, with perhaps one exception, *the coloured factor was internally placed, whilst the colourless formed the envelope.* It is, of course, impossible to explain this arrangement as being a retention in a mammal of the condition usually met with in ovipara; for in these latter creatures it is the nucleus which is colourless, whilst the parts exteriorly to it are coloured. When the elephant's blood-cells turned over in the slide, they presented much the appearance which a figure of a blastodermic vesicle does when its *area pellucida* is dumb-bell shaped, the envelope holding, in many cases, almost as favorable a relation in point of size to the nucleus, if so it may be called, as the blastodermic vesicle does to its *area pellucida.* This appearance I have noted also in the blood of the horse, of the rabbit, and of the human subject.

* Funke, 'Lehrbuch der Physiologie,' 4th ed., i, p. 213.

† Beale, in Todd and Bowman's 'Physiological Anatomy,' p. 137.

It is different enough from that described by Dr. Roberts in the Royal Society's 'Proceedings,' March 19th, 1863, as produced in mammalian blood-cells by the action of tannin; but, on repeating his experiment, I satisfied myself that the two sets of cases had this in common, viz., that they show that the homogeneous coloured mammalian blood-cells may be separated into two parts—one colourless and the other coloured—of which the latter shall occupy the smaller area.

I am inclined to think that the elephant's blood, though not fresh, still gave better opportunities for judging of the real nature of the appearance of nucleation than dried slides, such as those of the sloth's corpuscles, could give.

QUARTERLY CHRONICLE OF MICROSCOPICAL SCIENCE.

GERMANY. — **Archiv f. Mikroskopische Anatomie**, II, Heft. 4.—1. The first paper in this number of Schultze's 'Archiv' is by Dr. C. Kupffer, "*On the Development of the Embryo in the Genus Chironomus.*" Adverting to the observations of Weismann* "On the Development of the Dipterous Ovum," and to Mecznikow's† "Researches on the Embryology of the Hemiptera," the author states that his own observations up to a certain point agree altogether with those of the former writer, and with those of the latter to a great extent, although at the same time they tend to show, when compared with Meckznikow's statements, that there is probably a considerable difference between the mode of origination of the so-termed "folded layer" (Faltenblatt) in the Diptera and Hemiptera. Dr. Kupffer's observations have satisfied him that no rupture of the germinal membrane takes place, and consequently that the rotation of the contents of the ovum around the long axis cannot, as formerly supposed by Weismann and others, be due to such a rupture.

2. "*On the Structure of the Eye in the Gasteropoda, and on the development of the parts of the Eye in the Animal Series,*" by V. Hensen.—The author's observations in the present paper have been chiefly made on the eye of *Pteroceras,* of which an excellent account is given. In a former paper,‡ "On the Structure of the Eye in the Cephalopoda," he had already pointed out the chief peculiarities in the structure of the visual organ in the cephalophorous Mollusca, and these observations have been confirmed by his more recent researches.

The account of the retina is one of the most interesting and important parts of the communication, and in this and his account of the structure of the same part in the Cephalo-

* 'Zeitsch. f. wiss. Zoologie,' xiii.
† Ibid., xvi, p. 128.
‡ Ibid., xv.

poda will be found all that is known concerning it in the higher mollusca. The remarkable circumstance that the bacillar layer forms the innermost stratum of the retina instead of the outermost, as in the Vertebrata, seems to be as clearly established in the Gasteropoda as in the Cephalopoda.

In the retina of *Pteroceras* four layers may be distinguished—the most external 0·005 mm. thick. The external, which may be termed a "*basal membrane,*" is a homogeneous membrane 0·005 mm. thick. To this succeeds a layer of fine granular fibrillar nerve-substance, which is thickest at the bottom of the eye; from this layer proceed in a radial direction elongated nucleated cells containing pigment towards their apices; this layer may be termed the "layer of retinal cells." Internally to this succeeds a layer of clear substance (somewhat granular in the prepared eyes), which exhibits no trace of cells or nuclei, but consists of closely packed cylinders, each of which at its inner end supports a sort of cap of more strongly refractive material; this layer corresponds in all respects with the bacillar layer of the Cephalopoda. The entire retina is surrounded by an outer coat.

The nerve-layer consists of delicate fibres glued together by a somewhat granular interstitial substance, the fibrils being collected into minute indistinctly separate bundles, which cross each other frequently, but all run parallel with the surface of the basal membrane.

The cells composing the cellular layer are of several forms:—1. Acuminated cells, which become gradually attenuated as they approach the rods. 2. A second sort are distinguished as the "broad-ended cells," which differ from the former in the circumstance that they are always broadly truncated at the end directed towards the "rods." 3. The third kind of cells is very peculiarly formed; they are long delicate filaments, which exhibit at one point a fusiform enlargement, and close to their junction with the rods again widen, at the same time that they become occupied with pigment. Closer inspection shows that the fusiform enlargement is a *nucleus* having strong power of imbibing colouring matter, and which is surrounded by an enlargement of the fibre itself. Besides these three forms are found, but much more sparingly, very slender cells with a minute *nucleus.* The bacillar layer consists of cylindrical thick-walled tubes, which at the bottom of the eye are 0·097 mm. long and 0·001 mm. thick, and at the periphery 0·054 mm. and 0·010 mm. They are constituted of a gelatinous substance, which becomes granular in spirit.

The paper contains an interesting comparison of the author's results with respect to the retina with those of previous writers, as Leydig, Keferstein, Krohn, and Babuchin, who have investigated the structure of the eye in the Mollusca, and concludes with some excellent general observations on the relations of the eye and its different parts to the nervous centre, and with a copious table of comparison of the various parts of the organ of vision in the Vertebrata and various Mollusca, as the *Cephalopoda dibranchiata—Nautilus, Pterotrachea, Helix, Pteroceras, Pecten*, and *Asterias*.

3. "*On the Use of Creosote in the making of Microscopic Preparations*," by Prof. Dr. Ludwig Stieda, of Dorpat.—Acknowledging the value of the method proposed by Mr. Lockhart Clarke for the preparation of transparent sections of the organs, and especially of the nervous system, consisting, as is well known, essentially in the immersion of the sections first in absolute alcohol and afterwards in oil of turpentine, and then mounting them in Canada balsam, Dr. Stieda points out some of the inconveniences with which, as he thinks, this mode of procedure is attended. Amongst these he enumerates the loss of time attendant on the double immersion, and the difficulty, while immersing a series of sections in the alcohol, of preventing their becoming confused. In order to obviate these supposed objections he has, he says, been for some time in the habit of at once treating the sections with oil of turpentine without any previous dehydration by alcohol—a modification of the Clarkean method, which was first proposed by Reissner; but, from what is said, it is difficult to perceive that it has any advantage over the original proposal, and, in fact, to be attended in most cases with a great waste of time.

More recently Rindfleisch has recommended instead of oil of turpentine the use for the same purpose of oil of cloves. This oil requires that the preparation need not be immersed in alcohol for more than about two hours instead of twenty-four. And one recommendation of it, according to the proposer, is that, as the preparation is rendered transparent much more quickly than by turpentine, the glass cover may be more speedily applied, and thus the risk of contraction of the specimen avoided. According to Dr. Stieda, all the advantages assigned by Rindfleisch to oil of cloves are obtained in a higher degree by the use of creosote, a medium first proposed by Kutschin in his "Researches on the Structure of the Spinal Cord in the Lamprey."*

Kutschin's method, after placing the section upon the slide and removing the superfluous water, consists in applying

* 'Diss Inaugural.' Kasan, 1863.

to it a drop of creosote, when the section very quickly becomes transparent, and in fact almost suddenly, if the preparation had lain for about half an hour in a mixture of alcohol and ether. The preparation may then be at once covered and cemented in the usual way with dammara varnish. Dr. Stieda, in addition to what Kutschin recommends, puts a drop of a solution of gum dammara or of Canada balsam upon the preparation before applying the covering glass. Preparations which have not been immersed at all in alcohol are rendered transparent sooner by creosote than by oil of cloves.

The author then gives a list of various essential oils with which he has experimented, dividing them into two groups, the members of one of which act in the manner of oil of turpentine, and those of the other like creosote and the oil of cloves. To the first group belong the oils of turpentine, wormwood, balsam of copaiba, orange-peel, cubebs, fennel, milleflower, sassafras, juniper, mint, marjoram, lavender, cummin, cajeput, cascarilla bark, savine, and lemon; none of which have any advantage over oil of turpentine. In the second group of etherial oils, to which that of cloves belongs, we have those of gualtheria, cassia, cinnamon, star-anise, bergamotte, cardamoms, coriander, caraway, and rosemary. He considers it superfluous to make further experiments with these or other oils, as he finds creosote to answer every purpose that can be wished for in the speedy rendering of preparations transparent. The paper concludes with a recipe for a varnish to enclose wet preparations in glycerine or other watery fluids—viz., oxide of zinc or cinnabar, according to the colour that may be desired, is to be well rubbed up with oil of turpentine, and then added, in the proportion of a drachm of the oxide or two drachms of the cinnabar, to an ounce of a thick solution of gum dammara in turpentine. But what advantage this preparation possesses over the familiar gold-size, or gold-size with litharge, it is not very easy to perceive.

4. "*A Contribution to the Knowledge of the Anatomical Structure of the Tactile Hairs,*" by M. V. Odenius.—The greater part of this paper is occupied by an account of the structure of the peculiar spongy body which is found surrounding the roots of the tactile hairs, and the mode in which the nervous terminations are distributed; and the descriptions are illustrated by excellent figures.

5. "*Observations on Ciliated Epithelium,*" by Dr. P. Marchi, of Florence.—The principal point in this paper is the confirmation of the observation made by Friedreich, in

the ciliated epithelial cells of the intestinal canal in *Anodonta*, that there is a manifest continuation of the cilia into the protoplasm of the cell. In researches on this subject the author recommends a half or one per cent. solution of bichromate of potass, or a half per cent. solution of hyperosmic acid, and, as colouring matters, aniline or, especially, carmine.

6. "*Researches on the Development of the Urinary and Sexual Systems*," by Dr. C. Kupffer.—A former part of these researches was given in the first volume of the 'Archiv,' p. 233, and the subject as continued in the present embraces —1. The development of the kidneys in the fowl. 2. The formation of the allantois (?) in osseous fishes; in which, however, the author's inquiry seems to have been limited to *Gasterosteus aculeatus* and *Gobius minutus*.

7. "*On the Development of the Tissues in the Tail of the Tadpole*," by Prof. C. J. Eberth, of Zurich.

8. "*On the Developmental History of the Muscles*," by the same.—The chief object of this communication is to show the correctness of the view first fully established by Eilhard Schultze, that each transversely striped muscular fibre proceeds from a single cell. Schultze established this point from observations on the caudal and other muscles of the tadpoles of *Bombinator igneus* and *Triton*. He found that the single fibres, which could be traced in the above and a few other situations from end to end, are for the most part multinuclear cells, between which, however, lie numerous uninuclear cells with multiple nucleoli. This fact having been thus established in the Vertebrata, Prof. Eberth has endeavoured to show that the muscular fibres in some, at least, of the Invertebrata present the same conditions. His observations were made in the embryos and young of several Arachnida in different stages of development. He found the muscles of the *palpi* especially well adapted to his purpose. In these muscles he fully satisfied himself that each fibre was the product of a single cell.

9. The shorter communications at the end of the part contain—1. One by Prof. Neumann, of Königsberg, "*On the Presence of Crystals in the Blood in a Case of Leukæmia formed after death*."—The formation of these crystals commenced several hours after the blood was taken from the body, and on the next day had so increased that a large number of crystals was found in every drop of the blood. The crystals in question were very delicate, symmetrical, colourless, brilliant, slender spicules, which on closer examination were found to have the form of an elongated octahedron; that is to say, each half represented a four-sided

pyramid, whose base was a flattened rhombus. Some which appeared to be incompletely formed represented merely a four-sided pyramid with a rounded base. The length of the perfect crystals varied between 0·016 and 0·075, and the angles of the optical longitudinal section were between 18° and 162°. The crystals were insoluble in cold water; in boiling water they disappeared, but whether by solution or disintegration the author could not decide, but is inclined to think the latter, as he never observed any recrystallization on cooling. Neither alcohol, ether, chloroform, nor glycerine, even after long exposure, had any effect upon them. Acetic, tartaric, and phosphoric acids slowly dissolved them, as did also very weak solutions of soda and potass. The action of the mineral acids was peculiar; hydrochloric and nitric acid in strong solutions dissolved the crystals, which withstood the same acids in the concentrated form, in which, however, they became apparently softened, and were usually bent into an S form, or became crescentic. Strong sulphuric acid destroyed the crystals, which remained unaltered only in a moderately weak solution. Ammonia dissolved the crystals very slowly; they were unaffected by the putrefaction of the blood even after several weeks. Prof. Neumann is unable to give any opinion as to the chemical nature of these crystals, and goes on to cite other instances in which apparently similar products were met with. These are—(1) one mentioned by Magitot and Charcot in the 'Gazette hebdomadaire,' 1860, No. 47, also in a leucæmic individual; (2) a case by Robin and Charcot; (3) E. Wagner ('Archiv d. Heilkunde,' iii, p. 379); (4) several cases of apparently similar crystals in the sputa, by Förster ('Atlas d. path. Anat.,' taf. xxxiii, fig. 4; and by Friedreich ('Virchow's Archiv,' xxx, p. 382), who regarded them as "tyrosin," but evidently erroneously.

2. "*On Corpora Amylacea in the Gall-bladder.*"—These bodies were found in great numbers in the viscid mucus lining the walls of a gall-bladder, in which were contained numerous gall-stones. The largest measured no more than 0·028 mm. in diameter, and most were not more than half that size. Some were round, others egg-shaped; whilst some were tri- or quadrangular, with the angles rounded off. All presented a very distinct concentric lamination, the number of laminæ being usually in proportion to the size of the body; and in the centre of the larger ones was a distinct though small cavity, from which fissures radiated towards the periphery. The corpuscles all had a shining fatty aspect, and bright yellow colour. A watery solution of iodine

produced an immediate change of colour—the yellow hue passed into at first a pale and afterwards deeper green, which, on the addition of dilute sulphuric acid, assumed more of a bluish tinge. Sulphuric acid by itself produced a ruby-red colour. The bodies in question, therefore, exactly resemble the so-termed *corpora amylacea* of the nervous system, the prostate, and lungs.

3. "*Psorospermia in the Intestinal Epithelium.*"—The occurrence of Psorospermia in great abundance was observed in the epithelium of the small intestine of the rabbit in numerous instances. Though abundance of the Psorospermia were found free in the intestine, by far the larger number were contained in the epithelial cells themselves, few of which, indeed, were observed without them.

Zeitsch. f. wiss. Zoologie. XVI, Heft. 1.—The last part of this excellent journal contains papers on the following subjects:

1. "*Myological Researches:—I. The Connections between the Tendons in the Plantar Region in Man and the Mammalia,*" by Dr. F. Eilhard Schultze.
2. "*On Branchipus rubricaudatus,* n. sp.," by Dr. Klunzinger, of Cosseir.
3. "*On the Development of the Facetted Eyes of Tenebrio molitor,* Linn.," by Dr. H. Landois and W. Thelen.
4. "*Researches on some American Sipunculidæ,*" by Dr. W. Keferstein.
5. "*On the Cochlea of Birds,*" by Dr. C. Hasse.
6. "*On the Sonorous and Vocal Apparatus of Insects, in its Anatomico-physiological and Acoustic Relations.*"

Of these papers, which are illustrated with not less than eleven beautifully executed and many of them coloured plates, the most interesting, in a microscopical point of view, are those on the development of the eyes in *Tenebrio molitor*, and especially that on the sound-apparatus in the Insecta, of which we hope hereafter to give a full abstract, the paper itself being too long for insertion *in extenso*.

The discovery also of a new species of *Branchipus* is an interesting circumstance to those who attend to the study of the Entromostraca.

The species *B. rubricaudatus* was met with by Dr. Klunzinger in rain-water tanks at Cosseir, on the Red Sea, and the period at which he first observed it was some time after the winter rain. The Entomostracan occurred in great abundance, together with Cypridæ and larvæ of gnats, the males and females in about equal number.

The following characters of the new species are given:—

Body elongated, $\frac{1}{5}$th cent. long, transparent, colourless; ovisac and terminal forks of the tail vermilion; integument soft, dorsum arched, trunk compressed; abdomen half the length of the entire body, terminating in two long, horizontal, stalked, fimbriated spines. Head rounded behind, and above having an oval plate, and in the male presenting a frontal scute produced into a tubular process. First pair of antennæ filiform, reaching as far back as the first pair of feet; second pair far forwards on the frontal scute, in the male half as long as the body, but divided into several segments, and terminating in two spines, one of which is very long, slender, and toothed; in front of the second joint a long cirrhus, and on the remainder of the length numerous palpal lobes (Tästläppchen). In the female the antennæ are long, lancet-shaped, with adpressed hairs (plattbehaart). Simple eyes, composed of two trapeziform segments. First pair of maxillæ large, almost angular beneath, bent inwards; the second leaf-like, with a slender, angular, internal process supporting a seta; third pair rudimentary, rounded, with long setæ on the outer and anterior sides. Feet nearly all of equal length, with large branchial leaflets on the outer side, the upper serrated at the border and oval, and the lower digitate, and with an upper long, and median short lobe and three small inferior setigerous lobules; the inferior terminal lobes of the feet two in number, the internal wide and the outer slender. Abdominal sexual sac of the first and second segments on each side with a short cylindrical penis, with a slightly spinous, somewhat curved spicule on the inner side. Female with a long cylindrical ovisac terminating in an upwardly curved spine; two ovaries on each side, a uterus or egg-receptacle, vitellarium with its canal; ripe ova large, brown, mulberry-like, with smooth chitinous shell.

Monatsbericht der Akad. zu Berlin.—"*On the Sap-currents Rotation and Circulation in the Cells of Plants, with reference to the question of Contractility.*" By Professor Reichert. From a translation by Mr. Dallas, in the 'Annals and Mag. Nat. History.'—The result of my investigations may be summed up in the following paragraphs:

1. In all vegetable cells with rotating, circulating, or rotato-circulating currents, two parts are to be distinguished in the contents of the cellulose capsule—namely, the central "cell-juice" or "cell-fluid" situated between the axis and the "mantle-layer" (*Mantelschicht*) diffused between this and the cellulose capsule.

2. The "cell-fluid" is colourless, or coloured as in *Tradescantia virginica,* not very tenaciously fluid, and without albu-

men, but not well known as regards its other chemical properties; with respect to the circulation, it is the motionless, resting part of the cell-contents.

3. To the "mantle-layer" belong the following constituents:—The "mantle-fluid" as I have called it; the tenaciously fluid substance named "protoplasm" by Hugo Mohl; chlorophyl corpuscles, and other very small solid corpuscles, the chemical nature of which cannot be ascertained positively; the cell-nucleus; microscopic crystals; and the primordial utricle when this is present, which would form the boundary of the "mantle-layer" towards the cellulose capsule.

4. In the Characeæ the "mantle-fluid" cannot be overlooked; it was, however, erroneously assimilated to the tenacious fluid substance of circulating sap-currents, the so-called protoplasm-currents, and rightly distinguished only by Nägeli. In the cells with circulating sap-currents, it was first detected by E. Brücke in the stinging-hairs of *Urtica urens;* and it was observed in all the cells with rotating or circulating sap-currents examined by me. It is diffused between the cell-juice and the cellulose capsule, or the primordial utricle when this is present, is fluid, rich in water, exhibits only a small amount of albumen, and does not mix with the cell-juice. Its saline contents and the presence of other organic substances dissolved in it cannot be accurately ascertained; but it may be taken as a matter of course that it is in chemical reciprocal action with the other constituents of the mantle-layer.

5. The other constituents of the mantle-layer are bathed by the mantle-fluid or suspended in it. Amongst the constant ones, leaving out of consideration the questionable primordial utricle, are the viscid substance and the chlorophyl and other small corpuscles. The "viscid substance" is strongly albuminous, more or less tenacious as regards its state of cohesion, and presents itself in different and variable arrangement and form before and during the flow of the sap. Neither the nucleus nor the microscopic crystals are always to be found. Among the crystals were observed irregularly stellate ones of unknown chemical constitution (*Hydrocharis morsus ranæ*), and, in the stinging-hairs, oxalate of lime.

6. In the currents of the vegetable cell only the constituents of the "mantle-layer," not including the primordial utricle, take part. But whatever be the causes or forces by which these phenomena are produced in the constituents of the "mantle-layer," their action is demonstrably exerted especially, and exclusively, on the "mantle-fluid," which has hitherto remained quite unnoticed; this is thereby set in

a rotatory streaming motion. The movements of the other constituents of the mantle-layer (the viscid substances, nucleus, chlorophyl, and other small corpuscles, and microscopic crystals) are induced by the mechanical action of the rotating mantle-fluid upon them, with the co-operation of adhesion and, in the case of the viscid substance, of cohesion. The molecular movements of very small chlorophyl and other corpuscles visible under favorable circumstances remain excepted therefrom.

7. The rotatory movement of the mantle-fluid, as also its direction, is recognised especially from the constituents of the mantle-layer which float freely in it and are set in motion by it, namely, the freely moving chlorophyl and other solid corpuscles, and this both in the cells with rotation and in those with a so-called circulation. In the *Charæ* and in *Hydrocharis morsus ranæ* the viscid substance is also set in motion in separated fragments, in the *Charæ* in a globular form, and the current is then called "rotation."

8. The rapidity of movement of the freely floating and rotating substances under otherwise similar circumstances is secondarily dependent upon their mass, as also upon the influences of adhesion, which make themselves felt at the limit of the cell-juice, and still more strikingly at the cellulose capsule, and during the mutual contact of the floating constituents. In consequence of the operation of adhesion, it may also happen that the constituents passively carried on become momentarily or more permanently quiescent, or even acquire retrograde movements.

9. The mechanical action of the rotating mantle-fluid reveals itself also by the change of appearance and form of the viscid substance ("protoplasm") both in its freely swimming state (*Hydrocharis*) and also especially during its adherence to the cellulose capsule, whether transitory or permanent, in the neighbourhood of the nucleus or in some other favorable spot (*Hydrocharis, Urtica urens, Tradescantia*, &c.). These changes of appearance resemble in external aspect the motory forms of contractile tissues; they are, however, caused by the quite unavoidable action of the rotating mantle-fluid upon the viscid substance, are often demonstrably combined with a permanent displacement of the mass, and cannot be regarded as the effect of molecular movements of the particles in the substance itself.

10. It is a matter of course, and will also be established by direct observations, that the viscid substance diffused upon and adhering to the cellulose capsule in the vicinity of the nucleus or in any other spot, when in a favorably tenacious

state of cohesion, will be drawn out by the mechanical action of the rotating mantle-fluid into long filaments or cords, either simple or branched, and either terminating in free extremities or uniting again in circular or elliptical forms, and converted by the co-operation of adhesion into a more or less complicated net, diffused between the cellulose capsule and the cell-juice. This is the arrangement and configuration of the viscid substance in the cells of plants with a so-called circulating or circulo-rotating current; and this is the foundation of the so-called "protoplasmic currents" so often spoken of. When the viscid substance is thus arranged, the free-swimming granules very easily get into the domain of its fibres and cords, and may easily disappear entirely from the open region of the mantle-fluid, and in the struggle between the influences of the rotating mantle-fluid and of adhesion perform such vacillating and leaping movements as to remind one of the so-called "granular movement" of contractile substances. Lastly, in this arrangement the viscid substance may be set in motion in the region of its fibres and cords, as is proved by the progression on the fibres of swellings with imbedded granules or crystals; but the tenacity of the substance may be so considerable, and the power of the rotating fluid so small, that such a movement either does not take place at all, or not through the whole extent of the net (E. Brücke).

11. The structure of the ramified and net-like configuration of the viscid substance depends chiefly upon the degree of force of the rotating mantle-fluid, the form of the cellulose capsule, the point of attachment of the viscid mass on the cellulose capsule, and its relative position to the axis of rotation of the mantle-fluid, and, lastly, upon its state of cohesion.

12. There is no essential difference between the rotating, circulating, and rotato-circulating currents of the cells; in all, the rotating mantle-fluid is to be placed in the foreground; in it alone we can recognise the direct influence of the unknown causes of the currents, and this everywhere acts in the same way.

13. The other constituents of the "mantle-layer" exposed to the mechanical influence of the rotating mantle-fluid cause the current of the vegetable cell to vary in outward appearance; they will also, of course, present varying obstacles to it according to circumstances. Among the phenomena of this nature I may indicate that in the cavities formed between the resting masses of the viscid substance the rotating mantle-fluid may come to perfect rest, and that then molecular movements of free granules are detected in such cavities,—further,

that in *Hydrocharis morsus ranæ* the rotating mantle-fluid is divided into two regular rotating currents, running down separated from each other by a distinct piece traversing the cavity of the cellulose capsule,—and, lastly, that by means of such impediments at the rounded poles of the cellulose capsule reflux movements of the currents of the most various kinds may be produced.

14. Motory phenomena from which the existence of a contractile activity in the viscid substance, or in the other constituents of the cell-contents might be deduced, are entirely wanting in the plant-cells with currents investigated by me.

15. With regard to the movements of currents in the cells of plants, the first thing to be done is to discover the causes by which the rotating movements of the "mantle-fluid" are produced. But no physical or chemical processes by which this rotating movement might be brought about have hitherto been detected in the cells of plants.

FRANCE—**Comtes Rendus.**—*On the Vibrating Corpuscle of "Pébrine," considered as an organism producing Alcohol.*—In a recent Chronicle we noticed Dr. Balbiani's conclusions with regard to the nature of the corpuscles found freely floating in the fluids of silkworms attacked with the disease called pébrine. He maintained that they were psorosperms or pseudo-naviculæ of Gregarinæ, and, further, that they were vegetable. He appears to have been right in his view of their vegetable nature; but any one who has seen a *Gregarina* knows that it cannot be considered as anything but an animal organism. M. A. Béchamp has removed a quantity of the fluid from a worm afflicted with these corpuscles, and placed the fluid in a solution of cane sugar. In the course of a few weeks alcoholic fermentation was set up, and was allowed to continue for six months, when all the sugar was completely converted. At the end of that time the same corpuscles were still to be found in the fermented sugar, and M. Béchamp concludes that they are ferment-causing organisms.

"*On the Anatomical Arrangement of the Lymphatics in the Torpedos, compared with that presented by those of other Plagiostomi,*" by C. Robin.—The organs furnished with lymphatics in these animals are (1) the digestive tube; (2) the pancreas and its duct (the spleen is devoid of them); (3) the hepatic ducts, the gall-bladder, and ductus choledochus; (4) the oviducts, deferent canals, and the cloaca, but the ovary and testicle have none; (5) the peritoneum in front of the kidney; (6) the heart and portions of large vessels. The lymphatics of the different regions of the body above enumerated discharge

themselves, in the Torpedos, by one or several orifices into two prismatic triangular reservoirs, with their inner surface smooth and of serous aspect, and their cavity often traversed by delicate fibrous bundles. These reservoirs open into the dilatations which the venæ cavæ present in all the Plagiostomi before their arrival in Monro's sinuses. For various reasons, which he adduces, M. Robin believes that the chief use of the lymphatics is to charge themselves with the excess of that portion of the blood-plasma which arrives in the capillaries, and issues from them at each systole of the ventricles. In fact, we know that the quantity of lymph flowing is much greater when there is a considerable efflux of blood to an organ than when the latter is in a state of repose. M. Robin has made numerous observations in M. Coste's great fish laboratory at Concarneau, on living and fresh fish. He concludes, finally, that the cutaneous and subcutaneous vessels described by Monro, Hewson, &c., as lymphatics, are veins—some in the condition of true veins, others in that of venous sinuses. Beyond these veins it is impossible to inject any vessel, either by means of mercury or otherwise. The division of lymphatics into *superficial* and *deep-seated* or *visceral*, still adopted by some modern authors, must, consequently, be abandoned, the former kind of vessels not existing in this class of vertebrata.

Robin's Journal de l'Anatomie. January and February.—The current number of this journal contains some very good papers. M. Robin himself publishes his researches on the lymphatics of Plagiostomi, with some very beautiful illustrations. We have given a short notice of the paper above. Besides this there are—

"*Experiments on the Genesis of Leucocytes and on Spontaneous Generation*," by Dr. Onimus.—This appears to be a paper of very considerable ability, full of experiment and research. The author first shows that in an amorphous blastema "anatomical elements" are spontaneously produced. This production of cellules has, as one of its indispensable conditions, the phenomena of endosmose and exosmose, and they are produced more quickly accordingly as the phenomena of endosmose and exosmose are more rapid. Heat and the composition of the surrounding solids and liquids have a marked influence on the genesis of these leucocytes. No leucocytes, nor any kind of "anatomical element," form themselves in a blastema of which the fibrine has been coagulated. These statements are inferences from a series of careful experiments in which celliform bodies were produced by purely physical processes.

The author is led from this to experiment further on spontaneous generation, and finds that *vibriones* are not produced in the white of egg enclosed in a glass tube, although they are produced when the white of egg is enclosed in an animal membrane. And from various other considerations he concludes that the development of microscopic organisms in an organized substance depends, not on the presence of atmospheric germs, but on the conditions necessary for the putrefaction of the organic matter, and confesses himself a supporter of the doctrine of heterogenesis.

The paper below, from the 'Proceedings of the Royal Society,' leads to other conclusions from similar experiments.

Micrographic Society of Paris.—MM. Magnan and Hayem publish a valuable paper read to this society, "*On the Interstitial Tissue of the White Parts of Nervous Centres*," in which the views of Remak, Valentin, Rokitansky, Virchow, Kölliker, and Robin, are discussed.

ENGLAND.—**Royal Society's Proceedings.** January.—"*On the Formation of 'Cells' in Animal Bodies.* By E. Montgomery, M.D. This paper is one of very great interest, and hence we give it in full.

I. *Observations.*—So-called organic "cells," chiefly those of various cancerous tumours, were seen, on the addition of water, to expand to several times their original size, and at last to vanish altogether into the surrounding medium. The "nucleus" did not always participate in this change, but at times remained unaltered, whilst the outer constituents of the "cell" were undergoing this process of expansion. This curious phenomenon of extreme dilatation is intelligible only on the supposition that the spherical bodies in question are in reality globules of a uniformly viscid material, which by imbibition swells out till at last its viscosity is overcome by the increasing liquefaction. In embryonic tissues and in various tumours, single "nuclei" were seen, each surrounded by a shred of granular matter. On the addition of water there would bulge from one of the margins of the granular mass a segment of a clear globule, which continued growing until it had become a full sphere, which ultimately detached itself, and was carried away by the currents. At other times no such separate globule would be emitted, but the entire granular shred would itself gradually assume the spherical shape, ultimately encompassing the "nucleus," and constituting with the same the most perfect typical "cell." Not only single "nuclei" were found, each surrounded by a shred, but also clusters of two, four, or more were seen similarly enclosed by a proportionately large granular mass.

Under these circumstances it sometimes occurred that, on the addition of water, the whole granular mass of such a cluster became transformed into a large sphere containing two, four, or more "nuclei." The resulting body was to all appearance identical with shapes well known under the name of "mother cells." In all these cases the granular shred must have partly consisted of a viscid material, which, on imbibition, naturally assumed the spherical shape. Primary globules were surrounded by a secondary globule, and thus the typical "cell" was completed under the observer's eye. In some instances the globules resulting from the transformation of the granular mass were at first bright and transparent, the granules having completely disappeared. They, however, gradually re-formed, showing at first molecular motion, then crowding more and more, till at last the whole mass seemed to undergo coagulation. Alternate liquefaction and coagulation of the same material was found to play an important part in the development of "cells." Masses of certain viscid materials do not, on imbibition, expand uniformly throughout their entire bulk, but globules of a definite size are emitted, as many as the mass will yield. The crystalline lens of many young animals affords, when treated with water, a beautiful illustration of this fact. Its homogeneous material is transformed, under the influence of imbibition, into a vast number of globules of nearly equal size. Hyaline embryonic tissues display, under similar conditions, the same phenomenon. Certain inferences lead one to suspect that this size-limiting property is due to the crystallizing propensity of some ingredient of these viscid substances. Blood-corpuscles (human blood-corpuscles at least) are evidently tiny lumps of a uniformly viscid material. When broken up into fragments, each fragment assumes the spherical shape. On slow imbibition, they often emit a clear sphere, or a segment of one. In various specimens of fœtal blood, each blood-corpuscle was seen to emit as many as two or even three equal-sized globules, the original corpuscle being at last no longer distinguishable from its descendants. This is sufficient proof of the uniformly viscous nature of the blood-corpuscles. In many cancers the most recently formed part consists of mere fibres. These after a time become "nucleated." The "nuclei" are at first very elongated, this being due to the lateral pressure of the still fibrous texture. But as the mass gradually softens, the ovals expand more and more into spheres, forming the primary globules, round which, as has already been shown, a secondary globule is often seen to shape itself. Chemical differentiation transforms first one portion of the fibrous mass into viscid material.

This at once strives, by imbibition, to assume the globular shape. The remaining portion may or may not ultimately undergo similar transformation. Inflamed serous membranes become often densely "nucleated." In the deeper layers, the "nuclei" are very elongated. At the surface they are perfectly globular, and are detached as minute opaque balls. These balls are the granulation- or the pus-corpuscles. On imbibition, one portion of their soft material swells out, encompassing the rest, which, when forming a single uniform globule, goes under the name of granulation-corpuscle—when, on the other hand, broken up into several granules, constitutes the famous pus-"cell." This is an example of a second mode of "cell"-formation. Here the secondary globule is shaped from a portion of the primary mass. In some instances these "nuclei" or balls will, when still enclosed within the surrounding texture, undergo the above-mentioned change on imbibition; and thus whole rows of granulation- or pus-corpuscles are seen to form. This second mode of "cell"-formation is still more strikingly manifested in epithelial textures. In the mucous membrane of the nose, for instance, the faint oval "nuclei" of the large scales become during disintegration more and more distinct and globular. The surrounding material of the scale gradually liquefies, and the minute balls, thus liberated, expand by imbibition into mucus- or pus-corpuscles. It often succeeds in causing them to form in all perfection whilst they are still contained within the scale. In abscesses of the skin the pus-corpuscles are formed in exactly the same manner. They can often be watched, fully shaped, still enclosed within the scale. Here, it would seem, are "cells" not the result of life, but rather of death. The multiple "nuclei" of pus-corpuscles are not the result of over-fecundity, but are simply due to the disintegration of the non-imbibing portion of those oval or spherical sharply defined bodies which are themselves so well known under the name of "nuclei." The disintegration of this non-imbibing portion can be traced through all possible stages, down to the cluster of most irregularly shaped granules (which, notwithstanding, have been looked upon as the result of fissiparous division), and has been made to represent the crowning feature of the cell theory. The same minute balls found swimming in the serum of a blister were seen, when treated with water, to disclose single bright sharply defined "nuclei;" when treated with acetic acid, to reveal the most typical multiple nuclei of pus-cells.

II. *Experimental Verification.*—In all the above-cited observations the existence of a viscid imbibing material was

proved with almost conclusive evidence,—a viscid material which is capable of forming globules of a definite size, and which in the living organism actually forms such globules—shapes, the nature of which has been hitherto mistaken. After a long search, the substance known under the name of myeline was found to be the desired material. When to myeline in its dry amorphous state water is added, slender tubes are seen to shoot forth from all free margins. These are sometimes wonderfully like nerve-tubes in appearance. They are most flexible and plastic. From this curious tendency of shooting forth in a rectilinear direction, it was inferred that a crystallizing force must be at work. To counteract this tendency, and to oblige the substance to crystallize into globules, it was intimately mixed with white of egg. The result was most perfect. Instead of tubes, splendid clear globules, layer after layer, were formed, resembling closely those of the crystalline lens formed under similar conditions. Here was actually found a viscid substance which, on imbibition, formed globules of a definite size. The remaining task was comparatively an easy one. By mixing the myeline with blood-serum, globules were obtained showing the most lively molecular motion. When the serum somewhat preponderated, the whole of the globules seemed, after a while, to undergo coagulation, and appeared often as beautifully and finely granulated as any real "cell." When this mixture of myeline and serum was spread very thinly over the glass slide, there often started into existence, on the addition of water, small primary globules, round each of which an irregular mass of granular material became gradually detached from the glass slide. It at last shaped itself into a secondary globule, enclosing the primary one, and constituting with it, down to the minutest details, the most perfect typical "cell." In many instances the nucleolus did not fail; and the narrow white margin, so often mistaken for a cell-wall, was always present. Beautiful "mother cells" were formed in the same manner. The next endeavour was to form "cells" according to the second mode. If the amorphous myeline be very thinly spread on the glass slide, instead of tubes there will form bodies looking like rings. They are actually double globules, the inner globule being more transparent than the outer. They correspond to the inner and outer substance of the above-mentioned tubes. When these are left to dry, and then again acted upon with water, one portion will swell out into a clear globule, enclosing the rest as "nucleus." These "nuclei" are either large and single, like those of granulation-corpuscles, or they are

multiple, exactly like those of pus-cells. Whole layers of perfect pus-corpuscles are thus formed. But, of course, more complicated shapes occur as well—among these, for instance, many such pus-cell-like bodies enclosed within one large sphere. If, instead of water, serum be added to the thinly spread myeline, biconcave discs will form, only generally much larger than blood-corpuscles. "Cells" being thus merely the physical result of chemical changes, they can no longer afford a last retreat to those specific forces called vital. Physiology must aim at being something more than the study of the functions of a variety of ultimate organic units; and pathology will gain new hope in considering that it is not really condemned to be the interpreter of the many abnormities to which the mysterious life of myriads of microscopical individuals seemed to be liable.

Annals and Magazine of Natural History. Jan., 1867.—"*On the Organs of Circulation in Helix*," by Charles Robertson, Demonstrator of Anatomy, Oxford.—The author of this paper has kindly furnished us with a statement of the important conclusions derived from his researches. 1. A perfect injection can be made from the ventricle, of the arterial, capillary and venous systems, without any of the injection extravasating into the cavity of the body, and forming lacunæ of previous writers. 2. The existence of a capillary system of vessels between the arteries and veins in all parts of the body. 3. The kidney is not supplied with venous blood, but with arterial, which is collected from the posterior portion of the pulmonary chamber. 4. Injections from the foot or tentacle will, after a good deal of pressure, find its way into the veins and capillaries. This does not show that there is any direct communication between the veins and the cavity of the body, for it often happens when the veins of any of the mammalia are injected with size and vermilion, the size (but not the vermilion) will transude through the walls of the veins into the lacteals, often completely injecting them, and showing their branches much more completely than by injections from the lacteals themselves.* Much the same process takes place when the injection is forced into the cavity of the body; after a good deal of pressure the minute spaces are much distended with injection, and it transudes from them through the walls of the delicate veins, and so fills the venous system.

"*On the Perforate Structure of the Shell of Spirifer cuspidatus*," by Wm. B. Carpenter, M.D., F.R.S.—We extract the following letter entire, which will explain itself:—"I read

* Todd and Bowman's 'Physiology,' vol. ii, 1856, p. 473.

with much surprise in your number for August last (p. 144) the statement, quoted from 'Silliman's American Journal' for May, to the effect that Mr. Meek had ascertained the shell of *Spirifer cuspidatus*, not only in American specimens referred to this species, but in an Irish specimen received by him from Mr. Davidson, to be clearly punctate, contrary to the decision of Dr. Carpenter."

My determination of the imperfect character of the shell of that species was made, some twenty-five years ago, upon specimens obtained from St. Vincent's Rocks, near Bristol (where I was then residing), and authenticated by Mr. Stutchbury. In my Report to the British Association (1844, § 44), I pointed out that the *Sp. cuspidatus* of the Mountain Limestone differs from *Sp. Walcotti* and other Liassic Spirifers in not being perforated,—the absence of the superficial punctations seen upon the latter not being due (as Professor Morris had supposed) to the metamorphic condition of the shell, "since, although the structure of the shell is often obscured by this action, I possess sections in which it is extremely well preserved, and in which there is an evident *absence of the perforations*."

The distinction which I then drew between the two groups of *Spirifers* characterised respectively by the perforation and non-perforation of their shells, led Mr. Davidson to a more careful examination of the internal structure which they respectively present; and the differences which he then discovered were such as to lead him to separate these two groups generically, the designation *Spirifera* being retained for the original *Sp. striata, cuspidata*, and other imperforate species, whilst the perforated species were remitted to the genus *Spiriferina*.

The question as to the real character of *Sp. cuspidata* having thus come to be of no small importance, I have gladly responded to the suggestion of Mr. Davidson that I should re-investigate it; and I have commenced with a careful examination of my original Bristol sections. These again, I confidently affirm, show not the slightest trace of perforations, though the structure of the shell is well preserved.

I have obtained from the School of Mines, through Mr. Etheridge, and from the Museum of Irish Industry and that of the Geological Survey of Ireland, through Mr. W. H. Baily, chips of specimens from six different localities, all which specimens are vouched for by those gentlemen as genuine *Sp. cuspidata*. In not one of the sections I have made of these shells is there the smallest trace of perforations, though the structure of the shell is well preserved in every instance.

Further, at the suggestion of Mr. Davidson, I have examined chips from the shells of the following Carboniferous species, all of them more or less nearly allied to *Sp. cuspidata;* viz., *Sp. laminosa* and *Sp. distans,* prepared for me by Mr. Etheridge from the Museum of the School of Mines; and *Sp. subconica,* kindly transmitted by Mr. Carrington from Derbyshire. These, like *Sp. cuspidata,* show no trace whatever of perforations.

I cannot but believe, therefore, that my original determination of the imperfect character of the shell of *Spirifera cuspidata* remains unshaken by Mr. Meek's contradiction; and I can only suppose either that Mr. Meek (like Professor King) has mistaken the accidental black points which often present themselves on the surface of these shells for the punctations indicative of true perforations, or that (as he himself suggests) his punctated shell, though resembling *Sp. cuspidata* in external appearance, really belongs to a different genus. I trust that I shall be able, ere long, to clear up this part of the question, Mr. Davidson having written to request that Mr. Meek will send me chips of a shell belonging to his punctated *Spirifer,* and that Professor Winchell will send me chips of a shell belonging to his genus *Syringothyris.* When I shall have examined these, I shall report to you the results without delay.—I remain, gentlemen, your obedient servant, WILLIAM B. CARPENTER.

P.S.—Mr. Davidson permits me to add the following extract from a note which he has written to me after perusing the above:—"I have always placed the most implicit reliance on your admirable observations on the shell-structure of the Brachiopoda, and therefore, as I am personally concerned, would not have required the additional confirmation given by your recent researches; but I am not sorry that you should have again investigated the matter, as it can but strengthen the value of your discoveries,—and the more so, as I have always found this shell-structure to be combined with internal modifications, so that *a perforated species could not be generically the same as an imperforate one.* This has now been observed in so many instances, that the supposed exceptions brought forward by Messrs. Meek and King are, no doubt, the result of incorrect observation. To make this clear to the public was therefore a matter of some importance, and I am very glad you have done so."

March.—"*On Hyalonema,*" by Professor Max Schultze.—The beautiful "Glass Rope," specimens of which are brought to this country from Japan, has been the subject of some controversy lately in England; and the microscope has rendered

invaluable service in deciding the rights of the discussion. D. J. E. Gray seeks to prove, in opposition to the opinion of many naturalists, that *Hyalonema* is not a sponge, as supposed, but the axis and product of a polype. In this he is strenuously opposed by Dr. Bowerbank, who maintains, from microscopic evidence, that *Hyalonema* is a sponge. Professor Brandt, of St. Petersburg, classifies *Hyalonema* with the polypes, and regards a sponge observed at the extremity of very many specimens as a parasite. Professor Max Schultze in this paper maintains that the "glassy" part of the specimens is produced by the sponge, and that there is a parasitic polype, which is quite distinct, and that *Hyalonema* is properly, therefore, a sponge, which frequently has a coral parasitic on it. The structure of the glassy threads shows clearly that they are long sponge-spicules; and on this point Dr. Bowerbank and Professor Schultze agree. Dr. Bowerbank, however, declares that there is no parasitic coral, but that what appears to be such is really a "cloacal" system proper to the sponge. Professor Schultze's observations are, however, quite decisive on this point, for he has floated out the polypes themselves from dried specimens, and with the microscope has detected nematophores in their tissue. He also adduces other cases in which particular sponges are always affected with particular parasitic polypes, and gives a brief account of the microscopic structure of the true *Hyalonema*, which is fully figured and detailed in his monograph, 'Die Hyalonemen, ein Beitrag zur Naturg. der Spongien,' Bonn, 1860. There can be very little doubt but that the eminent German microscopist has set the question at rest.

"*On the Young Stages of a few Annelids*," by Alexander Agassiz.—We have not space now to notice this most interesting communication, of which a succeeding part is promised. At some future time we may be able to review M. Agassiz' observations; meanwhile we commend them to the reader's notice.

Proceedings of the Botanical Congress.—"*On the Structure of the Seeds of the Solanaceæ, &c.*," by Tuffen West, F.L.S. We have been favoured with a copy of this excellent paper by the author. He gives an interesting series of observations on the structure of the seed in Solanaceæ, Atropaceæ, and Scrophulariaceæ, illustrated by two plates, and points out the affinities indicated between these members of a group of allied orders which are indicated by these structures.

ITALY.—**Mem. della R. Acad. di Torino.**—"*On the Structure of the Skin in Stellio Caucasicus*," by Professor F. de

Filippi.—In his travels in Georgia and Persia the author observed this lizard, which he found to be herbivorous, and to have the power of changing colour under the influence of light, like the chamelion, but to a less degree. The causes of change of colour do not appear to be the same; and, moreover, this lizard turns pale under conditions which cause the chamelion to turn dark. There are two layers of pigment observed by M. de Filippi in the skin of *Stellio*—a superficial yellowish-white layer, and a deeper-seated black pigment. He believes that the change of colour is caused by the injection of the black pigment into processes of the pigment-cells, which pass through the yellow layer and come to view on the surface. The turgescence of a vascular glomerule is assigned as the cause of this injection of pigment. This structure, it is obvious, differs sufficiently from that described in the skin of the *chameleon*, and from the chromatophores of Cephalopoda, with which the author contrasts it.

"*On two Hydrozoa of the Mediterranean.*"—The same author has published some important remarks on the genus *Eleutheria*, and a new genius, *Halybothys*, which he has observed in the Mediterranean.

AMERICA. — **Silliman's Journal.** November, 1866. — "*On the Animality of the Ciliated Sponges and their Affinity with the Infusoria flagellata,*" by Professor H. James Clark. —In this paper Professor Clark gives a brief notice of his views on this subject, which will be more fully explained and illustrated in the 'Memoirs of the Boston Society of Natural History.' He describes, firstly, the *Monas termo* of Ehrenberg, with its flagellum, upper lip, mouth, and contractile vesicle, and he maintains that it ought to be regarded as a perfect animal. He then describes a remarkable genus, *Codosiga* (one of several new genera he has observed), which has all the appearance and structure of a *Monas* attached by a contractile band or stem to a hollow bell or calyx. Four or five of these are sometimes found attached to a common trunk by their narrow posterior ends. This form the author considers as linking *Monas* to the ciliated sponges. He describes *Grantia botryoides* as a tubular structure, in the glairy substance of which are imbedded and packed together a stratum of monads, identical almost with those of *Codosiga*, the only difference between individuals of the two genera being that the one has a calyx to which it is attached, the other a spiculiferous envelope. He therefore feels warranted in assuming that the whole group of *Spongiæ ciliatæ* is as intimately allied with the monociliate *Infusoria flagellata* as it is possible for it to be without constituting with the latter a uniform family.

Miscellaneous.—A new work on 'The Theory and Use of the Microscope' has just been published by Professor Nägeli, of Munich, and Herr Schwendener. Those interested in the study of the nematode worms should see Dr. Anton Schneider's 'Monograph of the Nematodes,' published at Berlin. It is a complete history of the species, anatomy, and development of this obscure group, and is most beautifully illustrated.

Gregarinæ in the Hair.—We would caution persons against accepting as truth the vague statements which have been made in newspapers lately on this matter. No satisfactory evidence has yet been offered at all of the existence of *Gregarinæ* in the hair under any circumstances. We have merely the statement of a Russian observer, some year or two since, to rely upon. Further, eggs of *Pediculus* might, under certain circumstances, present close resemblance to *Gregarinæ*. As to the bodies spoken of being *Gregarinæ* from the *Pediculus*, there is not a shadow of proof. No *Gregarinæ* have yet been figured or described from lice; and it is not very probable, though possible, that an insect with a haustellate, minutely opening mouth would get affected by these parasites. In addition to this, no *Gregarinæ* are at present known which are found on free and exposed surfaces, such as the hair; if they left the pediculi they would not leave them as *Gregarinæ*. The fact is very few people know what a *Gregarina* is, or have ever seen one, and hence the abundant nonsense which is written about them; they are becoming the scape-goats of writers on microscopic organisms—witness Dr. Balbiani's paper on the silk-worm disease.

NOTES AND CORRESPONDENCE.

Monochromatic Illumination.—Last year, in the October publication of your most excellent 'Journal of Microscopical Science,' which is forwarded to me by M. Baillière, of Paris, was published a letter from the Signor ab Count Francesco Castracane to the R. P. Secchi, about a certain mode of illumination, named a monochromatic one, and intended for the use of the microscope. One month after, a French review (the 'Cosmos') gave an account of a communication which had been made to the Institute about their mode of observing the microscopic phenomena. At last, in the first number of your journal for this present year, Mr. Barkas, of Newcastle-on-Tyne, has spoken also of this, Count Castracane's *new* mode of illumination. On that matter I wrote to these gentlemen, and received from both of them most kind letters. We have since interchanged some specimens of diatoms, and to-day I am happy to number these two learned micrographers amongst my correspondents.

But as to the homogeneous, monochromatic light, its use for the microscopic student is far from being new. Indeed, I have employed that light since it has been made known to me for this use by Amici; that is to say, eleven years since. However, when I perused the communication of Mr. Barkas and Count Castracane, my first thought was that a new mode of illumination was at stake, especially for the most hardly resolvable tests, and particularly the Nobert lines. I therefore begged some explanation from those two gentlemen.

It is certain that, using Amici's refracting prism, by means of which light is sufficiently dispersed, one may detect, with a very feeble objective, what the strongest could not allow to suspect with the direct white light. With the aid of such a prism, I have been able to view the specimens, for which I am indebted to the kindness of Mr. Barkas, together with some others, and to determine perfectly the striæ of the

Pleurosigma angulatum, P. macrum, Nitzschia sigmoidea, Grammatophora subtilissima, and *Surirella gemma.*

One must not believe, then, that, in order to attain such a result, it is necessary to make use of the large heliostal of M. Foucault, constructed by Dubose, of Paris, or by any other optician, and which is alluded to by Count Castracane in his letter to R. P. Secchi. A simple cone in flint, such as Amici indicated, is far from sufficient for observing microscopical phenomena. Nevertheless, the heliostal of M. Foucault may be used advantageously in order to obtain good photographic proofs.

The mode of illumination we are occupied with is not, indeed, sufficiently known; yet M. Nachet had touched the matter in the number of July, 1860, of your Journal (p. 208) in reference to his dark-ground illuminator.

Besides, the use of monochromatic light has been recently advised in a very good work—'La Photographie appliquée aux Recherches Microscopiques,' Baillière, Paris, 1866. But, as it is easily seen by the title itself, the question is more especially respecting photographic proofs than to microscopic researches. Notwithstanding, I invite all micrographers not to neglect this mighty mode of investigation.

Please to accept, gentlemen, the assurance of my best regards.—MOUCHET, Rochefort-sur-Mer.

P.S.—Peu habitué à écrire en anglais, je vous prie d'excuser mes incorrections, et de les corriger, si vous voulez bien insérer cette note dans le prochain numéro de votre journal. Je pourrai, parfois, vous adresser quelques articles concernant la micrographie.

New Curious Animalcule.—Seeing you have reported in your Journal No. XX, New Series, the very strange form of Lang's *Difflugia triangulata?,* I thought it would perhaps interest your readers to have a hint of a new, not less rare case of these protæform beings, which I have just met with, examining some water I have lately taken from a rivulet streaming out from the Gower Peninsula between Swansea and Oystermouth. The odd fellow I am speaking of was protruding itself from its tiny shell, not in the ordinary *radical* way, as its original name of *rhizopod* purports, but in a perfect symmetry with its oval carapace, as to look at first like two equal difflugiæ in conjunction, and what was more astonishing still to me was a hinder expansion of the carapace in the shape of a tail, for what purpose I really could

not guess. Looking at it after about an hour I saw it had just got out of focus, and as I brought it in again, its sarcode was nearly all drawn within, the carapace showing but a small stream like a pencil. After awhile I saw it protruding again, but in a much smaller circular compass. I was thinking at first if it might have some relation with a *Gromia,* or the *Amœba guttula,* as reported by Pritchard, plate xxii, fig. 6 ; but I am rather inclined to connect it with Bailey's exceptional amœboid *Pamphagus,* since its lorica or tunic is a good medium betwixt the rough carapace of the ordinary Difflugia and the soft and delicate silkwork-like of the Englyphœs. If any of your readers have observed a like animal I should be glad to hear of it more diffusely.

Another very strange form of animalcule I met with in examining a small bottle which Mr. Archer has been so kind as to send me from Ireland, was something like a king crab (the sword-tail *Limulus polyphemus*), or rather a minute *facsimile* of the celebrated fossil "*Cephalaspis Lyellii,*" with the only difference that its tail was bifurcated, and had two very delicate feelers or sensorial bristles at its head. But I hope that Mr. Archer will be able to give a better account of it in the proceedings of his "Dublin Nat. Hist. Society," if he has been lucky enough to meet with it.—J. G.

Living (?) Organisms in Chalk.—Strange as it may appear, M. A. Béchamp, one of the most celebrated of French chemists, alleges that chalk contains an abundance of minute *living* cellular organisms, and in proof of this assertion he points to the known fermenting power of chalk, and offers also microscopic evidence of the presence of these minute bodies. Chalk is known to contain fossil foraminifera in such large quantities that 100 grammes would furnish as many as 2,000,000 specimens. But, says M. Béchamp, in addition to these, chalk undoubtedly contains other organisms more minute than any of the infusoria, and these, though perhaps millions of years old, are still living. Take, he says, from the centre of a piece of chalk a portion of the substance, crush it, and mix it with pure distilled water, and examine it with a high microscopic power, and you will see numerous minute brilliant points exhibiting a peculiar trembling movement. That this movement is not what is termed *Brownian,* M. Béchamp considered to be proved by the facts :—(1) That these particles, when isolated, act as powerful ferments ; and (2) that when analysed they are found to consist solely of carbon,

hydrogen, and nitrogen. We must confess that M. Béchamp's views startle us, and we should like to see them corroborated. All microscopists are familiar with peculiar trembling movements of the particles of matter contained in the cavities of crystals. Further, we should like to know how M. Béchamp contrived to separate these wonderful organisms, which he terms *microzyma cretæ*, from the organic remains of the surrounding foraminifera. A living organism as old as the chalk formation is certainly an eighth wonder of the world.—*Lancet*.

Note on a Double Earthworm, Lumbricus terrestris.—This is the only example I have ever seen of a double worm, and was given to me last autumn by my friend Mr. Thomas, who received it from a gardener when alive, and soon afterwards it was placed in spirits of wine. On account of its xtreme rarity, I have drawn up the following brief account of its peculiarities.

The rings of the body presented the usual appearance from the first to the eighty-fifth, when the body divided into two symmetrical halves (fig. 1), each of which presented the usual appearance of the terminal part of the body of an ordinary worm. Each of these lateral appendages commenced by dis-

FIG. 1.

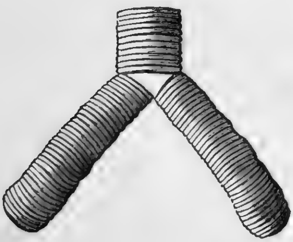
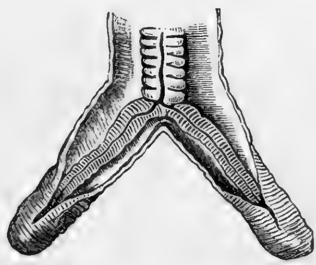


FIG. 2.



tinct and separate rings applied to the eighty-fifth, and not by its bifurcation into two parts. A small triangular membranous space was thus left on the dorsal and ventral surface between the junction of three rings. The following are the dimensions of the body and the number of rings:

Length from the lip to point of bifurcation, 2 inches; rings, 85. Each lateral appendage, $\frac{1}{3}$th inch; rings, about 105.

On reflecting the skin from the dual surface of the body

and appended portions, it was found that the large vessels, the digestive tract, and nerve-cord, divided at the eighty-fifth ring, and were symmetrically arranged in each of the lateral appendages (fig. 2). The generative organs were fully developed and quite normal; the setæ well developed on each appendage. Each appendage had a distinct terminal anus.—CHARLES ROBERTSON, Demonstrator of Anatomy, Oxford.

Slides by Post.—Having seen the discussion recorded in the last number of the 'Microscopical Journal' on the subject of sending slides by post, and having had bitter experience of the horrors of the middle passage, I would venture to offer to microscopists the following plan, which I have never known to fail. Cut two narrow strips of card-board, and gum them across the slide on each side of the cover (*a*, *a*, fig. 1), so as to prevent a slide or the side of the box from

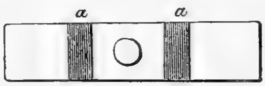


FIG. 1

touching the cover; roll up four or five slides in paper, and place them in one of the ordinary postal boxes. The box should be left bare, and an ordinary parchment label attached

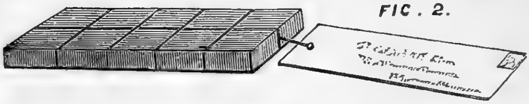


FIG. 2.

to it by lacing a cord round it, as in fig. 2; on this label the direction should be written and the stamp affixed.—T. G. STOKES, Aughnarloy.

Erratum.—In the List of Fellows duly elected on the 12th of December, 1866, the name of William Maguire, Esq., was given in this Journal instead of William Moginie, Esq., 35, Queen Square, W.C.

PROCEEDINGS OF SOCIETIES.

Royal Microscopical Society of London.

December 12th, 1866.

R. J. Farrants, Esq., in the Chair.

The minutes of the preceding Meeting of Council and of the Special General Meeting of November 14th were read and confirmed.

Six presents were announced, and thanks returned to the respective donors.

The following gentlemen were elected Fellows of the Society:—Peter Murray Braidwood, M.D., Infirmary, Carlisle; Thomas Crook, Esq., Thames Ditton; Christopher W. Calthrop, Esq., Royal Westminster Ophthalmic Hospital, Charing Cross; Thomas Curties, Esq., High Holborn; Charles Davis, Esq., 14, Wimpole Street; Rev. J. H. Ellis, Brill Parsonage, Thame, Oxon.; William J. Gray, M.D., 23, Princes Street, Cavendish Square; R. T. Lewis, Esq., 1, Lowndes Terrace, Knightsbridge; William Moginie, Esq., 35, Queen Square; William Cunliffe Pickersgill, Esq., Blendon Hall, Bexley.

The following papers were read:—"On a New Condenser," by the Rev. J. B. Reade. "On Two New Species of Tube-bearing Rotifers," by Mr. H. Davis. (See 'Trans.,' p. 13.)

Mr. Jabez Hogg believed, with the author of the last paper, that this was a new species of Rotifer; but he could not quite agree with him as to the precise mode in which the gelatinous case of the animal was built up; and certainly he did not think it could be formed in the same way as that of *Melicerta ringens*, namely, by pellets. The author had favoured him with specimens, and he had closely watched them, without having once seen any attempt to build or add anything to the cylindrical sheath into which it so entirely withdraws itself on the approach of danger; and with regard to the Rotifer "jerking down a clot of granules," as de-

scribed by Mr. Davis, he (Mr. Hogg) rather looked upon this as the expulsion or rejection of digested food. The transparent character of the *case* led him to the conclusion that it was of the same nature as that enclosing other groups of Rotifers. In most of them some two or three eggs could be seen, and therefore it might rather be looked upon as a receptacle for the ova. Upon gently pressing out one of the eggs, which are ciliated, it swam off, and after a little time attached itself to the side of the glass cell. The young animal was presently hatched, and soon became enclosed in a similarly transparent sac. The ciliary trochal disc moved with beautiful regularity, and the two long antennæ extended at right angles to it had a remarkable appearance, and were certainly long enough to be employed in a building process, but could not be discovered by him in the act.

The speaker then described to the meeting, by the aid of drawings, changes which he had observed, and modifications of the shape of the animal, in part resulting from the introduction of carmine, &c., into the water. In conclusion, he thought it quite right to place this Rotifer among the *Œcistes*.

Mr. Lobb was of opinion that the animal differed very much from the *Œcistes*, and, aided by the drawings used by the previous speakers, he described, by making alterations in them as he proceeded, the result of observations of several specimens with which Mr. Davis had favoured him. He thought it a very interesting subject for continued examination, and that eventually the animal would not be classed with the *Œcistes*.

Mr. Slack thought this rotifer was one of the most remarkable and interesting he had ever seen; he agreed generally with Mr. Davis in arranging it provisionally under the head of *Œcistes*, but he was at the same time of opinion that when the group to which it belonged had been better examined some new arrangement would have to be made. If a number of specimens of these animals were placed in the hands of different observers, and the animals were—as they usually were—influenced by very varying humours, there would be seen in the result of such a series of simultaneous observations a most beautiful diversity and discordance of opinion. As evidence of this, he produced a sketch which he placed beside Mr. Davis's drawing, because it exhibited the creature under so different an aspect that, although both portraits were correct, they might be supposed to represent different animals. The new rotifers he found to be very highly ciliated, and, in addition to the cilia ordinarily engaged in forming the wreath, and giving rise to the rotatory appearance, there were other rows of cilia, some of which he had seen engaged in sweeping against or "licking" vegetable matter in their vicinity. With Smith and Beck's $\frac{1}{20}$th, and careful illumination with Ross's $\frac{4}{10}$th condenser, the wreath cilia appeared to be as thick as the hairs in a broom. Mr. Slack concluded by recommending a re-examination of allied species, as he thought their ciliary apparatus would probably be

found more complicated than had been supposed. In subsequent observations he said that the red pigment of the eyes was segmented in a curious way; probably it disappeared gradually in old specimens.

Mr. DAVIS, in reply to an observation made by Mr. Hogg, to the effect that on his applying carmine to the water the animal had evinced its objection to such treatment by at once closing up its case, said he thought it very probable that too much carmine had been introduced; he had himself noticed, in several instances, that directly carmine was placed in the water the animal had seized upon and begun to deposit upon its case many particles of the colouring matter.

January 9*th*, 1867.

R. J. FARRANTS, Esq., in the Chair.

The minutes of the previous meeting having been read,

The following gentlemen were elected Fellows of the Society: —Colonel J. H. Hudson, Royal Clothing Factory, Pimlico; R. Barrett, Esq., Wallingford; P. Matthews, Esq., 17, Lower Berkeley Street, Portman Square; S. Piper, Esq., 19, Lansdown Road, Dalston; F. Blankley, Esq., 23, Belitha Villas, Barnsbury; M. Theodore Eulenstein, Stutgard; Thomas Shepheard, Esq., 12, Bridge Street Row, Chester.

Dr. BOWERBANK presented a work "On the British Spongiadæ."

The following papers were read:—"On a Portable Cabinet, and on a New Slide for Opaque Objects," by S. Piper, Esq. "On a New Portable Microscope," by Newton Tomkins, Esq. "On the Crystallization of the Sulphates of Iron, Cobalt, and Nickel," by R. Thomas, Esq.; communicated by Mr. Ladd.

The Chairman announced the list of officers proposed by the Council for election at the ensuing general meeting. This list coincided with the list of officers elected. (See 'Trans.,' p. 23.)

In reading this list, the Chairman observed that one of the Honorary Secretaries of the Society, Mr. Blenkins, had been compelled, by pressure of other engagements, to relinquish the post he had held in connection with the Society for many years past. The announcement that the Council had passed a unanimous vote of thanks to that gentleman on his retirement was received with approval by the meeting. The Chairman pointed out also that the list was merely a suggested one on the part of the Council, and that it would be quite competent for members to move the election of other persons than those whose names were now submitted.

At the conclusion of the reading of Mr. Piper's paper, specimens of the cabinets were passed round the room, and a slight discussion

arose upon one or two alterations suggested by those present; but Mr. Piper remarked that he had already experimented in the direction indicated by some of the speakers, and found that the cabinets made in the form and of the materials of those now introduced were the most useful and practicable that could be made. One objection, as to the slightness of the card-board material of which the cabinets were made, he disposed of in a very summary manner, by throwing one of the trays which had been handed round the room upon the floor, and jumping violently upon it several times. This *experimentum crucis*, as the Chairman remarked, was decisive; and on the tray being handed round again quite intact and unharmed in any way, the inventor was loudly cheered.

Mr. J. Newton Tomkins, F.R.C.S., read a paper describing a travelling or pocket microscope invented by Mr. William Moginie. (See 'Trans.,' p. 20.) One of the microscopes, and the various useful contrivances it embodied, was exhibited, and Mr. Tomkins remarked that by its aid he had been able to distinguish the sharp and delicate markings of some of the highest test objects. As a student's microscope, he considered the instrument to be beyond all praise; but he thought it would also be a boon to microscopists generally, especially to those who devoted attention to microscopic studies in the field.

Mr. Varley also warmly eulogised the instrument and its belongings. A new arrangement of a dipping-bottle used in searching ponds had particularly attracted his attention. In this case the bottle was screwed firmly to the end of the telescopic rod, so as to enable it to be used as a kind of scoop or ladle in places where, from the nature of the object searched for, it could not be otherwise secured.

Dr. Bowerbank, who was received with great cheering, said he could not refrain from expressing the great pleasure he felt at being present once more at a meeting of the Society—a pleasure which he had been compelled to deny himself of late in consequence of the state of his health; but finding himself in London to-day, he had been unable to resist the temptation of attending the meeting. His pleasure on the occasion had been much enhanced by having seen the beautiful little instrument which Mr. Tomkins had just described. He thought it a beginning of a movement in the right direction, as highly finished instruments were not within the reach of every one, and even those who possessed such were not disposed to carry them into the field; and therefore the instrument before the meeting met a want which had too long been unsupplied. "I have watched the proceedings of the Society," continued Dr. Bowerbank, "through its publications, and I see how young and ardent members have arisen in our ranks, and how the microscope of this Society, instead being, as formerly, a mere toy, is becoming a real working tool in the hands of scientific men. The papers made public through

the Society are highly valuable as records of patient research and investigation, and I feel that we, who have laboured much in years past in bringing the microscope to its present efficient condition, are amply repaid by the gratification we experience in seeing the instrument used to such good purpose by the young and ardent philosophers who now carry forward the fame of our favorite science. As to our instruments themselves, our microscopes have obtained a leading position in Europe, and I sincerely trust that there will continue to arise among us members who will ever maintain the high character of our countrymen as microscopic observers."

On Dr. Bowerbank resuming his seat, the Chairman rose and said—I take this opportunity of offering you the best thanks of the Society for your valuable work presented to the Library, 'On the British Spongiadæ;' and on its being pointed out that the volume presented was one of twenty copies only which contained portraits of the author, Dr. Bowerbank remarked that the photograph represented him with a microscope on the table by his side, and it might be interesting to the members to know that the instrument there shown was the first one to which the ploughed sliding apparatus was attached; the lever stage was also the first one made. This microscope had been in constant use during the last twenty-five or thirty years, and it was still in good condition; the lever stage was just as easy and smooth, and as fine in its adjustment as it had ever been.

Mr. Robert Thomas read a paper, "On the Crystallization of the Sulphates of Iron, Cobalt, and Nickel." (See 'Trans.,' p. 19.)

The Chairman, on announcing that the Anniversary Meeting of the Society would be held on the 13th of February, again called attention to the desirability of securing the autographs of every Fellow of the Society in the book which had been provided for the purpose.

March 13*th*, 1867.

The minutes of the preceding meeting were read and confirmed.

A paper "On Gregariniform Parasites of Borlasia," by Dr. McIntosh, was read. (See 'Trans.,' p. 38.)

Mr. Jabez Hogg, F.L.S., said the general distribution of these Gregariniform bodies seems in the present day to have led to a general but erroneous opinion with regard to their being found in hair; and this circumstance will, perhaps, afford an opportunity for now saying a few words on the subject. Mr. Ray Lankester has enlightened us with some excellent papers on Gregarinæ, which may be found in the Society's 'Transactions.' They seem, as Dr. McIntosh has stated, to be discovered in salt-water animals, and I have myself found them in many fishes. In short, they appear to be a part of the sarcode covering of the muscular tissues

of animals. You will remember that a correspondent of the 'Times' stated in that journal that he had found these bodies in the muscular tissues of some slaughtered cattle which had been infected with the cattle plague, and this was mentioned as a new discovery. But all who are acquainted with microscopic subjects know that they have been made out for years, and have puzzled all microscopic observers as to their origin and purpose in the animal economy. These bodies appear, as I have stated, to be a part of some degeneration of sarcode, or of the muscular tissue itself; and there we seem to be either at an issue or a stand-still as to what more can be made of the matter. But as regards the question whether these bodies have been discovered in "chignons," this seems to have been all a myth. Dr. Tilbury Fox, a very able investigator in these matters, having made a careful examination of numbers of the hairs used as materials in the manufacture of chignons, could not discover anything of the kind; and how such an idea could have got abroad seems as difficult to account for as those extraordinary paragraphs in the 'Times' from time to time, copied from 'Galignani' and other foreign sources, and which never could have found their way into a journal of any scientific pretensions. But I may tell you that Mr. Norman, who is highly qualified to inquire into these matters, has during the last few weeks made hundreds of investigations, without having once discovered anything approaching to a body of the kind in any of the hairs used in this particular manufacture. He called on a wholesale dealer—and you may judge of the extent of his business when I tell you that he informed Mr. Norman that the late outcry against chignons had caused a falling off of several hundred pounds in his monthly returns—he went through the whole stock of this dealer, and never once found anything of the kind. The only instance met with by Mr. Norman was in dirty and ill-prepared hairs, where he met with a few of the so-called "nit-cases," or pediculi shells; but these were, of course, in all instances, empty. Dr. Tilbury Fox, too, states that he has only seen in hair of German origin a species of "mildew" fungus, which might give rise, if implanted on the surface of weak persons, to the disease called "ringworm." We may therefore conclude that the story about gregarines in hair is totally devoid of truth.

Mr. Ince, F.L.S.—I may mention that the letter to the newspapers was written by two young men by way of hoax.

A vote of thanks to Dr. McIntosh for his paper was passed.

A paper by Mr. W. U. Whitney, "On the Change which accompanies the Metamorphosis of the Tadpole, &c.," was read. This paper was illustrated by a series of remarkably beautiful drawings on a large scale.

Mr. Jabez Hogg spoke in very high terms of Mr. Whitney's exhaustive and elaborate paper, and the novel mode in which he had worked out the subject. Mr. Hogg continued—The great and new feature in Mr. Whitney's paper appears to be the novel

method employed in the removal of the integument or skin which covers and conceals the vessels of the gill, thereby disclosing the circulatory system and its true affinities. This is a point which has hitherto not been so well understood, for even Dr. Carpenter does not appear to have worked out this question, and all we know of the affinities of the circulatory and respiratory systems of the animal is from the elaborate paper of M. Milne-Edwards. That very nearly approaches the truth as to the various systems; but even M. Milne-Edwards has not gone so far as Mr. Whitney, to whom is really due the merit of having discovered the true affinity of the two systems. There is no doubt he has entirely cleared up the point. It no longer, I think, admits of being put as Dr. Carpenter puts it, in his work on the microscope, where he says—" If Mr. Whitney's account of the circulation in the tadpole be the correct one," &c.; there can be no reasonable doubt of the correctness of these observations, and none, I am sure, can be entertained by any who has heard him this evening, and seen his beautiful illustrations. Mr. Hogg then proceeded to suggest that a point as to the efferent and afferent vessels might be cleared up by means of the micro-spectroscope. He thought it quite within the scope of the instrument, by the absorption-bands, to show the blood in the two systems, and the way in which the arterial and venous capillaries change places. However, since it so nearly coincided with the systemic plan in the higher animals, he had no doubt of the correctness of Mr. Whitney's observations, which present us with a very complete account of the circulation in the more perfect as well as in the transitional state of the tadpole.

A vote of thanks was then passed to Mr. Whitney for his paper, and the meeting adjourned to Wednesday, 24th April, when it was announced that the soirée of the Society will take place.

LIST OF BOOKS PRESENTED TO, OR PURCHASED BY, THE ROYAL MICROSCOPICAL SOCIETY DURING THE YEAR 1866.

	Presented by
Annals and Magazine of Natural History, Nos. 97, 98, 99, 100, 101 and 102, 103, 104, 105, 106, 107, 108	Purchased.
Intellectual Observer, Nos. 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59	The Editor.
Household Magazine, No. 1	Ditto.
Photographic Journal, Nos. 164, 165, 166, 167, 168, 169, 170, 171, 172	Ditto.
Popular Science Review, Nos. 18, 19, 20, 21	Ditto.
The Canadian Journal of Science and Art, Nos. 59, 60, 61, 62	Ditto.

Quarterly Journal of the Geological Society, Nos. 84, 85, 86, 87, 88	The Society.
Journal of the Linnean Society, Nos. 36, and 33, 34 .	Ditto.
Natural History Transactions of Northumberland and Durham, Parts I and II . . .	Ditto.
Proceedings of the Academy of Natural Science of Philadelphia, Nos. 1 to 5 . . .	The Academy.
Circular No. 6, War Department, Washington .	United States Government.
Works of Robert Brown, vol. I . . .	Purchased.
Œuvres d'Histoire Naturelle—Bonnet, 18 volumes .	Dr. Millar.
The Anatomy of Vegetables—Nehemiah Grew .	Ditto.
Papers by Isaac Lea, LL.D., on New Species of *Unionidæ* . . .	Acad. of Nat. Science, Philadelphia.
Recent Memoirs on the Cetacea . . .	Purchased.
Transactions of Linnean Society, Vol. 25 . .	The Society.
La Sarcini de l'Estemac, par Dr. W. Saringar. Ditto, Dutch, the original work . . .	Presented.
Histoire de la Mouche commune de nos Appartements, avec planches, 1790 . .	F. C. S. Roper, Esq.
Observations on the Medicinal Leech, by Dr. J. R. Johnson	Ditto.
Verhandlunger Zoologisch-botanischen Gessellschaft in Wien	Presented.
Patent Office Report, United States, Vols. 1 and 2, 1862.	
Bulletin l'Annuaire de l'Académie Royale de Belgique, 3 vols.	The Society.
Monograph of the British Spongiadæ, 2 vols. .	Dr. Bowerbank.
Monograph of the British Spongiadæ, Vol. 2, by Dr. Bowerbank	Purchased.
Du Cholera Asiatique. Dr. Pacini . .	The Author.
Results of the Micro-chemical Examination of Extract of Flesh, by H. Dean and H. B. Brady . .	Ditto.
The Entomologist, No. 34 . . .	Ditto.
British Journal of Dental Science, 15 numbers .	The Editor.
The Journal of the Society of Arts, 23 numbers .	The Society.
Observations and Experiments with the Microscope on the effect of various Chemical Agents on the Blood, by Thomas Sharman Ralph, M.R.C.S. . .	The Author.

Quekett Microscopical Club.

December 28*th*, 1866.

Ernest Hart, Esq., President, in the Chair.

A paper was read by Mr. Cooke, "On the Progress of Microscopical Science in 1866," in which his remarks were classed under three heads:—1. The establishment of new Societies, and increased vigour in old ones. 2. The mechanical improvements in microscopes, microscopical apparatus, and manipulation. 3. The contributions to microscopical literature. Under each of these heads numerous details were given.

The questions deposited in the Question-box, comprising a variety of subjects, were read and discussed.

Fourteen members were elected.

January 4th, 1867.

The first soirée of this Society was given in the noble library and hall of University College, the use of which was liberally granted for the occasion by the Council of the College. Notwithstanding the very severe frost, there was a numerous attendance of members and their friends. About 120 microscopes and objects were exhibited by the members and the well-known makers, although the objects of interest were not entirely confined to microscopes only. Numerous diagrams were suspended on the walls, amongst which may be noted a curious collection of paintings of floral subjects, the work of native Indian artists; also a series of beautifully executed diagrams, kindly lent for the occasion by Her Majesty's Board of Inland Revenue. The Graphotyping Company displayed various specimens of their process of engraving. Mr. King exhibited salmon-hatching, and some parasites found on the gills of the adult salmon. Mr. James How afforded much amusement by exhibiting the induction-coil in connection with Giessler's tubes. Not the least interesting object in the rooms was the microscope constructed by Professor Quekett at the age of sixteen years, "made up of materials furnished by a common roasting jack, a lady's old-fashioned parasol, and pieces of brass purchased at a neighbouring marine-store dealer's, and hammered out by himself." This was lent by Mr. Stone, of the College of Surgeons. There were also many interesting diagrams lent by the Council of the Royal College of Surgeons and by Dr. Carpenter.

January 25th, 1867.

ARTHUR E. DURHAM, Esq., Vice-President, in the Chair.

A paper was read by Mr. N. Burgess, "On the Cuticle of Plants, and the best means of Separating and Mounting it." Having given considerable attention to this subject, his experience had taught him that the best method to effect separation was by maceration for a few weeks, after which he floated the cuticles on to a glass slide and put them away until required. A discussion followed, in which Mr. Slade recommended the use of nitric acid. A discussion likewise took place relative to the source whence the hairs are obtained commonly called "hair of larva of Dermestes."

Ten members were elected.

February 22nd, 1867.

ARTHUR E. DURHAM, Esq., Vice-President, in the Chair.

A paper by Mr. F. Kitton, of Norwich, was read, "On the Publication of New Genera on Insufficient Data," which will be found on p. 118.

Seven members were elected.

The proceedings terminated with a conversazione.

OLD CHANGE MICROSCOPICAL SOCIETY.

This Society, which was formed in the establishment of Messrs. Leaf, Sons, & Co., in April last, consists of about eighty or ninety members, under the Presidency of Charles Leaf, Esq., F.L.S., &c., one of the firm, gave its first soirée on Monday, February 25th, at Willis's Rooms.

It was attended by a numerous and fashionable company, about 800 ladies and gentlemen being present, all of whom seemed highly gratified with the variety of entertainment provided. Of course, the chief feature of the soirée was the microscopes, upwards of 120 of which were exhibited; Fellows of the Royal Microscopical Society, Members of the Quekett Microscopical Club, the Old Change Microscopical Society, and Messrs. R. and J. Beck, Browning, Baker, Bailey, Collins, Crouch, How, Ladd, Murray and Heath, Powell and Lealand, Ross, Robbins, Salmon and Steward, all furnishing their quota.

The microscopes were arranged on six tables, and (with R. and J. Beck's hexagonal stand as a centre) occupied the entire length of the room. The monotony of the tables was very pleasingly relieved by a large and beautiful collection of camellias, azaleas, callias, pelargoniums, and other plants.

The objects exhibited were so many and so varied that it is almost impossible to enumerate; but amongst them were the *Lophossus crystallinus* by the President and E. G. Lobb, Esq.; *Conochilus Volvox* by Dr. Millar, F.L.S.; *Euplectilla aspergillura*, *Hyalonema mirabilis*, and a collection of calcareous sponges, British and fossil, and recent sponges from various countries, by Charles Tyler, Esq., F.L.S., &c. A series of Atlantic soundings, and a large collection of corals, fossils, geological specimens, &c., by Robert Etheridge, Esq., F.G.S., of the Geological Survey. *Volvox globator*, by W. R. May, Esq. Recent Polycystina, &c., by Major Owen, F.L.S., &c. Asparagin, by W. M. Bywater, Esq., Secretary of the Quekett Microscopical Club. The gall fly, by T. G. Watson, Esq. Pigment-cells of the pelargonium, &c., by

N. Burgess, Esq., in a microscope giving a field of twenty-four inches' diameter.

Professor Smith, of Kenyon College, U.S., exhibited Tolle's New Binocular Eye-piece, giving binocular effect with a monocular microscope; also a Mechanical Finger, by which the most minute objects may be picked up and deposited upon a slide.

The Old Change Society exhibited *Stephanoceros Eichhornii*, various Hydras, circulation in the ova of salmon, and polarization with high powers. Amongst the makers of microscopes Messrs. Powell and Lealand exhibited circulation in *Valesneria spiralis*, *Volvox globator*, portrait of Princess of Wales in beetle's eye; T. Ross, leaf of cactus, scales of fern, the palate of a limpet, with Slack's new diaphragm eye-piece, by which a beautiful effect was obtained; C. Collins, ova of toad, young snails (alive), &c.; J. H. Steward, circulation in frog's foot, selections of diatoms, &c.; Murray and Heath, ova of lobster, young prawns, &c.; C. Baker, a variety of objects, and a new field microscope designed by Mr. Moginie; W. Ladd, sulphates of iron, nickel, &c.

In an adjoining room Mr. How exhibited Dr. Maddox's series of photo-micrographs with the oxyhydrogen light, the induction coil, and Giessler's vacuum tubes; and Dr. Millar, F.L.S., the magnesium lamp.

In another room was shown Wyld's magneto machine by Mr. Ladd; folios of water-colour drawings from the collections of W. Leaf, Esq., and the President; Roman and Mediæval antiquities from the Library of the Corporation of London; autographs, ancient keys, &c., by Deputy Charles Reed, F.S.A.; several rare engravings, by D. N. Chambers, Esq., F.S.A., &c.

Frank Buckland, Esq., Inspector of Salmon Fisheries, exhibited the process of salmon hatching.

Mr. King, parasites from the gills of salmon ova from Malham Tarn, impregnated on the 7th November and hatched on the 3rd January; the egg with the eyes, fish one day old, double trout, trout with fungoid disease, circulation in the salmon, and aquaria.

During the evening the Old Change Choral Society performed a selection of glees, and Mr. Rogers several solos; Mr. Aeschmann solos on the violoncello, and Miss Weatherhead and others solos on the grand piano.

Amongst the company present were Dr. Beale, F.R.S.; Charles Brooke, Esq., F.R.S.; Dr. Down; R. Farrants, Esq., F.R.C.S.; Jabez Hogg, Esq., F.L.S., Hon. Sec., Royal Microscopical Society; Dr. Lankester, F.R.S., &c.; Henry Lee, Esq., F.R.M.S.; Professor Morriss; Deputy Charles Reed, F.S.A.; Henry J. Slack, Esq., Hon. Sec., R.M.S.; F. H. Wenham, Esq., F.R.M.S.; Tuffen West, Esq., F.L.S., &c.

Oxford Microscopical Society.

November 27th, 1866.

Mr. Robertson exhibited some beautiful injections of *Helix pomatia*—the Roman or edible snail. He stated that, after more than two hundred attempts, he had succeeded in demonstrating what was, to the best of his belief, as yet unknown to comparative anatomists—the existence, viz., in this animal, of a completely closed capillary system, differing in no respect from the same system in the higher animals. These capillaries were most strikingly displayed in the crop, the intestine, and the mantle. In some of the preparations the distribution of the arteries was shown and explained to the Society. In one specimen, in particular, the minute branches of anastomosis between the arteries and veins on the wall of the pulmonary chamber were very clearly defined. He has thus proved that the pre-existing notion of a lacunar circulation in these animals is a mistaken one; the mistake having, as he supposes, arisen principally from the way in which the operation of injection has hitherto been performed (it being the custom to introduce the injecting-pipe into the foot or tentacle, whereas his own successful injections were made from the heart), partly also from the improper consistence of the injecting fluid employed.

Mr. Robertson next drew attention to a glass trough made in one piece, without any joint, and devised by himself for the purpose of receiving dissections to be photographed. The dissection is first stitched on talc, with a piece of blue paper behind it, and then placed in spirit in the trough. Owing to the absence of any joint in the trough, the light is admitted equally on all sides, and a perfect image of the object can, with a little careful manipulation on the part of the photographer, be thus produced. Several photographs of dissections taken in this way by an Oxford photographer were likewise exhibited.

Dublin Microscopical Club.

October 18th, 1866.

Mr. Archer exhibited a very minute new species of Cosmarium, with its zygospore, gathered at Kilbride, near Blessington, county of Wicklow. This little form he had taken on previous occasions, but never before conjugated. As the mature plant itself is one of exceeding simplicity and very minute, it is hence liable perhaps to be overlooked, or at least regarded as possibly but some simple Palmellaceous cell. Nevertheless, Mr. Archer had always felt it

was a thing distinct, a good and true species of Cosmarium, but hesitated to describe it, inasmuch as this—a mere very minute elliptic cell—would doubtless with difficulty be received as a species distinct from every other little elliptic cell; he felt that it might be hard to convey to others, either by description or a figure, the characteristics of this little humble production as these presented themselves to himself, sufficiently evident as he might think them. Hence he was now the more pleased to find this plant conjugated, and to perceive that its zygospore could never be mistaken, in its outer characters, quite irrespective of its dimensions, for that described for any other species.

The following may serve as a description:

Cosmarium (Corda).

Cosmarium lobatosporum, sp. nov.

Frond very minute; nearly twice as long as broad; general form elliptic; ends rounded; constriction an extremely shallow and very gentle narrowing. Zygospore rounded, somewhat irregularly lobed; the lobes surmounted by one or two minute pellucid conical and pointed spines or mucrones; cell-wall reddish. Length of cell $\frac{1}{1660}''$, breadth $\frac{1}{2500}''$, diameter of zygospore about $\frac{1}{1000}''$, including spines.

Devoid, however, as this little form, in the unconjugated state, may be of any very striking or tangible characters for descriptive purposes, yet Mr. Archer thought he might venture on saying that it would appear to him a mere waste of words to contrast it with any other minute elongate cell not desmidian. Amongst Desmidieæ, Mr. Archer thought that perhaps the form most likely to be confounded with this might be *Penium Mooreanum* (ejus). (See 'Quart. Journ. Mic. Soc.,' n. s., Vol. IV, p. 179, Pl. VI, figs. 34 to 44), and he exhibited the figures in illustration. But the latter is notably broader in proportion to its length, and is larger, and quite without any narrowing at the middle; in fact, it is barrel-shaped, except as to the ends being however rounded (not truncate). Further, the arrangement of the endochrome is quite different; in *Penium Mooreanum* the chlorophyll is in longitudinal "fillets," that is, deposited in longitudinal plates, radiating from the axis of the cell; in the present plant it is scattered with a central granule in each segment. In a word, they belong to two seemingly well-marked genera. But even regarded specifically, besides what has been alluded to, see the remarkable differences in the zygospore of each. It seems not at all necessary to contrast this new form with any others at all approaching, such as *Cosmarium Cucurbita*, well distinguished by its considerably greater size and its punctate cell-wall and groove-like constriction, or with any species of Mesotænium or Cylindrocystis. But above and beyond what has been mentioned, this new form differs from every other desmidian whose conjugated state is known, by the remarkable more or less lobed character of the zygospore, the lobes or projections surmounted by the short conical spines. At

first sight, under a low power, this might possibly call to mind certain examples of that irregularly figured plant *Polyedrium lobulatum* (Näg.), or (less likely) that seemingly more rare plant *Sorastrum spinulosum* (Näg.); but a moment's inspection under a higher power reveals that it is something altogether different from both. A goodly number of examples being present of this new form, both the mature and empty cells and of partially formed zygospores, all doubt was speedily set aside as to this little Cosmarium being a new and distinct species, not perhaps after all more marked by its peculiar zygospore, than, simple as it is, by the mature form itself, when carefully studied and contrasted with its allies.

Dr. Moore exhibited *Closterium Pritchardianum* (Arch.) from the tank in the warm house watered from the "Tolka," in the Botanic garden. It had since become conjugated, maintaining all the characters originally described for it. It had produced a stratum over the leaves of *Ouvirandra fenestralis* detrimental to the latter. Indeed, Dr. Moore stated that unfortunately this plant was very prone to become choked up more or less by various growths; last year an Œdogonium had seated itself upon it, much to its injury.

Rev. E. O'Meara exhibited and described a number of new species of Diatomaceæ which he had discovered in the rich gathering made by Dr. E. Perceval Wright off the Arran Islands. These he named *Navicula Hibernica*, *N. pellucida*, *N. denticulata*, *N. Wrightii*, *N. Amphiodes*, *Pinnularia Arraniensis*, *P. constricta*, *P. forficula*. Descriptions of these, with figures, will appear in the 'Quart. Journ. Mic. Science.' (See p. 113.)

Mr. Archer exhibited, new to Britain, *Hormospora transversalis* (Bréb.), which he had taken at Kilbride, county of Wicklow. This exceedingly elegant little filament seemed, with us at least, to be very rare; he had never before encountered it, and in the present gathering it was extremely sparing. With a reference to de Brébisson's paper and figure ('Annales des Sciences Naturelles,' 3 ser., tome i. Bot., p. 25, t. i, fig. 2) it would be here unnecessary to describe the plant. But Mr. Archer thought it might perhaps be worth while to draw more particular attention to the fact of the self-division of the individual elongate cells taking place in the longitudinal direction, than de Brébisson seems to do. It seems a singular occurrence amongst these simple cellular structures, the self-division taking place in elongate cells otherwise than transversely, that is, through the shorter diameter. Here the sharp line formed by separation of the parent cell-wall by a suture could be seen, and the opposite apices of the cells thus oftentimes presented an acute angle, formed by the extremities of the sharply-defined margins of the parent cell-wall,—adding to the beauty of the plant.

Mr. Archer likewise exhibited fine specimens of the various stages of conjugation in *Closterium lineatum*, showing its remarkable double zygospore; these formed exceedingly striking and handsome objects. It was worthy to note the seeming individualisation of the halves of the parent cells which took place, so that although self-division had not set in, these halves may be regarded as physiologically two distinct cells. In the early stage two canals are formed, of course side by side, within which the two spores are formed, the adjacent surfaces becoming more or less flat-sided by mutual pressure. Nothing could be more exact than the fine figure of the mature pair of zygospores and mode of attachment of the parent fronds than that given in Ralf's 'British Desmidieæ.'

November 15*th*, 1866.

Dr. John Barker exhibited a specimen of *Arcella dentata* of seemingly exceptionally pellucid character, thus showing the pretty dotted markings and undulate outline to advantage.

Mr. Archer, in continuation, exhibited a series of rhizopodous forms from fresh water, some of which had not yet been recorded in Ireland, and one he thought he felt justified in considering the type of a new genus. With a view to make the exhibition of the series now shown somewhat more explanatory and generally interesting, Mr. Archer endeavoured to give a *résumé* of the system of classification of the Rhizopoda adopted by Dr. Carpenter, who divides them into three groups, founding, seemingly naturally enough, his distinctions on the characters presented by the Pseudopodia; that is, the Lobosa, or those with lobose finger-like pseudopodia, *e. g.*, Amœba, Difflugia; the Radiolaria, or those with exceedingly slender filiform pseudopodia, occasionally somewhat branched; *e. g.*, Actinophrys, Cyphoderia, Euglypha, in neither of which groups the pseudopodia become naturally fused on contact; and, lastly, the Reticularia, or those with slender pseudopodia, which, on contact, become fused or mutally incorporated, oftentimes in a reticulose manner, frequently irregularly branched, and here and there notably expanded, *e. g.*, Gromia, Foraminifera at large.

The examples now exhibited were altogether confined to the two former groups.—The Lobosa were represented by various Difflugiæ and Arcellæ. Here, again, Mr. Archer would venture to delay one moment to mention that the more frequently these creatures presented themselves to him, the more it seemed to force itself upon him that they were not things convertible, but that the same forms again and again turned up; also when cases of "conjugation" were met with, which, at certain periods, does not seem a very rare phenomenon, it still always took place the same species with the same species, within each particular genus.

Amongst the Difflugian (Lobose) forms which here presented themselves was that exceedingly well-marked and withal very pretty species *Difflugia triangulata* (Lang). The figure given by Mr. M. H. Lang ('Quart. Journal of Microscopical Science,' No. XX, October 1865, p. 285) is abundantly graphic, in order to recognise the animal at a glance.

Mr. Archer likewise showed some other interesting forms belonging to the Radiolaria in Carpenter's sense, one altogether new, and besides which several others seemingly more or less uncommon, or, at least, for the first time recorded as Irish, were presented. In this rich gathering those which seemed to be common were *Euglypha alveolata*, *Actinophrys sol*, and *A. Eichhornii*, of which latter there was on the table a fine specimen which had engulphed three Stentors, proportionately not very moderate morsels. Of those not before recorded in Ireland, although possibly not uncommon in suitable localities, there were several distinct and well-marked forms. Two of these were *Trinema acinus* (Dujardin), and *Cyphoderia margaritacea* (Schlumberger).

One of those now exhibited seems to be absolutely new; it appears to find, however, its closest affinity in the genus Pseudodifflugia (Schlumberger); specimens of forms seemingly referable to the latter genus, as time did not now permit, Mr. Archer hoped to be able to present at the next meeting of the Club. Of the new form he hoped that a figure would shortly appear in the 'Microscopical Journal;' hence it would be unnecessary to give any details here.

This new form, however, seems to be distinguished from every freshwater rhizopod by having *at each opposite extremity* of the test a distinct rather wide aperture, furnished with a short, well-marked neck. From each of these opposite apertures there issues a dense compact tuft of slender filiform occasionally branched pseudopodia. For this genus Mr. Archer would propose the name Amphitrema.

Dr. E. Perceval Wright regarded the exhibition that evening by Mr. Archer of so many forms of fresh-water Rhizopods as one of great interest. He had had abundant opportunity of examining many specimens of the form, for which Mr. Archer had very properly constituted a new genus, Amphitrema. He was aware that in supporting Mr. Archer's views on this subject he was venturing on very debateable grounds. Some, as Dr. Wallich, reasoned that because the animal forming the test may be of the same nature in a certain number of forms, it mattered not what shape, or what size, or what material the test should be composed of; all the forms having such an animal should be included in the same genus. Now, while such reasoning is, doubtless, to a certain extent correct, and while Dr. Wright did not find it hard to believe that all the Rhizopodal forms had a common descent from single Amœboid form, still he believed it to be advisable, and in keeping with

modern ideas of classification, to take certain well-marked differences—which must in most instances be arbitrarily selected—and to place the animals possessing these differences into groups by themselves. It was not of much consequence whether these groups received the name of genera or species, as long as these differences were sufficiently constant to be easily recognised. In the case of Amphitrema, although the test was something of the same nature as that met with in some species of Difflugia, and although the animal itself did not appear to differ essentially from some other actinophryan testaceous Rhizopods, still, finding it always provided with two orifices for the emission of its pseudopods, and those pseudopods of a radiolarian type, entitled it, Dr. Wright thought, to generic distinction, and this opinion would not be altered by the even strong probability of its being a transitional form between an amœban and an actinophryan, so covered with a chitinoid test, and loaded with mineral matter, that, except through these two openings, it was unable to protrude its pseudopods. Dr. Wright had also found *Cyphoderia margaritacea* (Schlumb.) in a gathering from the Castle grounds at Parsonstown. The general resemblance that this form bears to *Lagynis baltica* of Schultze, as figured by Carpenter, was very great; but Dr. Wright, having seen a specimen, was not prepared to regard Schultze's species as only a variety of Schlumberger's. At the same time, he agreed with Dr. Wallich that there was no occasion for the separation of Cyphoderia from Dujardin's genus Euglypha.

The Rev. E. O'Meara exhibited two new species of Surirella, which he named *S. pulcherrima* and *S. gracilis*, descriptions and figures of which will hereafter appear in this Journal.

December 20th, 1866.

Dr. John Barker exhibited the larval state of a small dipterous insect, affording another pretty instance of "homes without hands." The larva was in great part enveloped in a compressed quadrangular case, expanding towards the posterior end, elliptic in section; the aperture elliptic, semi-trumpet-shaped, everted and a little flattened. Through this the larva protruded its head and three pair of legs, which were long, and, with the exception of the first pair, which were short and ended in a forceps, were armed with long and slightly curved, unequal hooks. By means of its legs the creature crawled along the bottom and sides of the vessel, carrying the case swinging obliquely above. The two valve-like sides of the case approximated towards the base, so as to present a slit; it seemed composed of structureless chitine, with a few hairs on its surface. It was about $\frac{1}{20}''$ in length, and $\frac{1}{45}''$ broad at the base. The larva, after it had been in confinement

about a fortnight, anchored itself by a sort of byssus to the sides of the vessel. First, a mucous substance was deposited on the glass at four different points; then four sets of cords (about fifty in each) united these attachments, two to the long axis of the mouth of the case, and two to the angles of the base. The animal lay much shortened, with its head curved round, its legs close together, entirely within the case. This larval form was found abundantly in December instant, in bog pools, on the west side of Carrick Mountain, near Wicklow.

Dr. Moore showed the hairs of *Isonandra gutta* (gutta-percha plant), and drew attention to their structure.

The Rev. E. O'Meara exhibited several new species of Diatomaceæ, descriptions and figures of which are intended to appear in this Journal; these he respectively named *Cocconeis clavigera*, *Rhaphoneis suborbicularis*, *R. hispida*, and *R. Jonesii*.

Mr. Archer drew attention to, and exhibited specimens of, a minute unicellular chlorophyllaceous plant, certainly one he had never seen before; and, though great diversity showed itself as regards the individual cells, they had all a common character, so that at a glance they might be recognised as one and the same thing.

Viewed so far as regards outward form only, this plant might be regarded as falling under Nägeli's genus Polyedrium; but it differs so greatly therefrom in its mode of growth that it could not be referred at all to that genus. It forms polyhedral cells of varying sizes, and of the most varied number of angles, sometimes even subrotund and cornute. In all the specimens each angle or extension seemed to be terminated in a kind of knob-like, hyaline tubercle—as it were a kind of thickening of the cell-wall; and by certain of these tubercles the cells often mutually cohered to the number of two, three, or four together.

It will thus be seen that the external form points to the genus Polyedrium, with no described species of which it could, however, be at all confounded, even thus only externally viewed.

But in Polyedrium the mode of increase is by a brood of small young Polyedria, indefinite in number, being formed by a breaking up of the entire cell-contents of the parent Polyedrium. These escape by the bursting of the parent cell-wall, and seem by degrees to assume the form of the parent.

In the present plant, on the other hand, the cells increase by transverse division—one old cell into two—and they often cohere by a kind of fusion at the knob-like extremities of certain of the prominences, reminding us somewhat of the indeed still more regular manner in which the frustules of Diatoma, for instance, hang on together.

Now, this must necessarily place this plant away from Polyedrium. Pending a knowledge of the genus Trochiscia (Kütz.), it

might be premature to say that in that genus it should find its place, inasmuch as Kützing has not given any details as to the mode of growth in any of the four plants he describes ('Species Algarum,' p. 162). May this plant possibly be *Trochiscia multangularis* (Kütz.), l. c.? A thought strikes one here—might it be just possible that Kützing, in describing some of his forms, may have had some partially or fully developed zygospore of some Desmidian before him? The plant now exhibited was, at least, no zygospore, as its mode of growth, if not its form, wholly precludes.

Dr. Ryan showed the pollen of *Monstera deliciosa*, forming a pretty object under reflected light.

Dr. Moore gave some particulars of the plant itself, referring to its leaves with natural apertures and its edible fruit.

Mr. Archer, in continuation of the exhibition by him at the previous meeting, brought forward some additional rhizopodous forms, some not before recorded, he believed, in this country, as well as an additional one, which he thought must be considered the type of a new genus amongst Radiolarian species.

Amongst the described Lobosa probably one sufficiently noteworthy, though, perhaps, not uncommon, was *Difflugia tuberculata*.

Amongst seemingly undescribed Lobosa was a form, in character of test, most nearly related to *Difflugia triangulata* (Lang), but of quite a distinct figure. As in that species there were no foreign adherent particles whatever, and the pellucid test showed similar markings, but smaller, comparable to "broken ashler-work in building." This seems to be a kind of test to which Dr. Wallich, in his very interesting, though Mr. Archer ventured to think not conclusive paper, does not allude. All his forms of Difflugia (setting aside of course Arcella, which he would include in the same genus) are more or less coated by foreign particles. Nor does he allude to the peculiar reticulated markings comparable to "broken ashler-work" on any more or less denuded specimens. Hence this character of test, it may be presumed, must be rare, or at least local, as his collections were made so largely and from so very wide sources.

This new form differs from *Difflugia triangulata* in not being at all triangular or lobed, but in broad view regularly balloon-shaped or pyriform, slightly drawn out into a somewhat wide neck-like extension and compressed; round a lateral line or centre of the narrow side projects a more or less broad *keel*, which thus forms a border when the broader view is towards the observer; this keel bears just the same markings as the rest of the test. The whole is thus not unlike the form of a pocket-flask, with a wide neck, *plus* the keel. This keel is not continued on to the aperture, which is round and smooth and without a lip, but it usually becomes narrowed off where the gradually sloped off body becomes contracted into the sub-cylindrical neck-like portion. For this form

Mr. Archer would venture to propose the name *Difflugia carinata.*

Passing on to other types, Mr. Archer was happy at being able to show two distinct but related forms, which time did not permit to bring forward at last meeting, and which so far as he could make out seemed referable to the genus Pseudodifflugia (Schlumberger) ('Annales des Sciences Naturelles,' 3 sér., tome iii, p. 256). This genus seems to form a very distinct type, and to judge from his paper alluded to, not apparently met with by Dr. Wallich. These seem to be rhizopods with Radiolarian (Carpenter) pseudopodia and with tests apparently comparable to those of Difflugia. These he would not here delay by dilating upon, but hoped to give an idea of them by figure on another occasion.

The new form was very distinct indeed from any of the foregoing, and, perhaps, might be regarded, along with *Acanthocystis turfacea* (Carter), as possessing more affinity with certain marine forms than any other hitherto recorded as being found in fresh water.

Before, however, passing on to mention and to show a specimen of this new form, Mr. Archer took occasion to exhibit examples of the species jnst alluded to, *Acanthocystis turfacea* (Carter), never before, as identified, exhibited in Ireland. He also showed Carter's figure (' Annals of Natural History,' 3rd ser., vol. xiii, p. 36, pl. II, fig. 25, and 3rd ser., vol. xii, p. 262). This is an organism not very rare with us in suitable localities, but never, seemingly, plentiful. It is rare to get a good view of the very long and slender pseudopods ; but there can be no doubt of the general correctness of Carter's description. The spicnles, however, are described by Carter as crescentiform—they seem rather to be short bacillar, and to be held together by some common bond, flatly arranged in one stratum round the periphery ; and thus held together the whole acquires the character, more or less, of an integument of some tenacity, projected from which are the peculiar shaped spines, and through which emanate the filiform pseudopodia.—So far as one could venture to judge, Carter seems to be quite right in supposing Acanthocystis to be quite another thing from *Actinophrys brevichirris* (Perty).

To pass on to the new form Mr. Archer desired to exhibit, this might be most briefly defined by saying it represented an *Actinophrys plus spicula.* The sarcode body possessed, immersed and entangled in the outer region, beyond all computation densely numerous, very slender, elongate, pellucid spicules, acute at both ends, and lying in every possible direction. In the central portion of the body were contained one or several hollow globular clusters of somewhat large rounded chlorophyll granules; the pseudopods numerous, exceedingly slender, very long, and fine. As this remarkable form would require a figure to convey a just idea of its character, Mr. Archer would here refrain from any further attempt at description for the present. Should, how-

ever, this turn out truly a new type, he would venture to propose a new generic title, Raphidiophrys, and call this curious form *Raphidiophrys viridis*.

Mr. Archer further drew attention to a new form in the genus *Achlya* (Nees v. Esenb.) diœcious, the oogonia curiously and densely cornute, which he called *A. cornuta;* a figure of which, and more detailed reference, appears in the present number of this Journal.

Mr. Archer exhibited (for the first time in Ireland) that charming rotiferon, *Conochilus volvox*. This seems to have been frequently enough taken in England, and, though now seemingly for the first time recorded in Ireland, Professor Greene, of Cork, had informed Mr. Archer that he had before taken this handsome species.

Newcastle-upon-Tyne Mechanics' Institution Fine Arts' Exhibition.

Conversazione and Microscopical Soirée.

There were upwards of two dozen microscopes, with a number of interesting objects to be seen through them. In so numerous a collection it is impossible, with the limited space at our command, to go through the whole *seriatim;* and yet, at the risk of laying ourselves open to the charge of being invidious, we cannot refrain from making reference to two or three of the number, as being novel and unique. In addition to those to which reference will be found made in Mr. Barkas's lecture below, we may mention several objects exhibited by Messrs. Mawson and Swan, one more especially showing the beautiful and interesting effect produced by crystals under the polarized light. Perhaps the most wonderful—as it was certainly the most novel—object in the whole exhibition, was that of an ordinary photograph of Shakspeare, as seen through the eye of a beetle. The latter was thus shown to be a series of lenses, each not more than $\frac{1}{900}$th part of an inch in diameter. The microscope is converted into a telescope, the eye of the beetle forming the object-glass, the effect being that, on looking through the ordinary eye-piece of the instrument, the photograph is multiplied by as many times as there are lenses of the beetle's eye within the focus of vision, the whole of the figures being exactly equidistant from each other. It was exhibited by Mr. John Brown, sen., and, it is needless to state, was a source not only of attraction, but of wonder and admiration, to the many who had the privilege of seeing it. Mr. J. Davison exhibited a fresh-water hydra, a very curious object, one peculiarity about it being that it cannot be destroyed by any process of cutting, &c.; the only effect of that being that, instead

of destroying them, their number is increased. We must not omit to mention a very fine variety of injected preparations, by A. B. Stirling, Esq., of Edinburgh, and exhibited by Mr. Craggs. One remark more, and that is with respect to the instrument exhibited by Mr. J. Martin, a working mechanician, of South Shields, who, having turned his attention to microscopes, stands perhaps alone in the district as an amateur manufacturer of microscopes, which approach, either in point of finish or usefulness, those produced by many of the most practical manufacturers. The exhibition was, altogether, of the most interesting description, the "wonders of the microscope" being largely added to by the specimens presented for inspection. Between the parts of the concert,

Mr. T. P. Barkas proceeded to give some "Observations on the Microscope as an Educational Agent and Instrument of Scientific Research," of which the following is an abstract:—"The eye saw that which it brought with it, the power of seeing," was true, not only in relation to the æsthetical aspect, but also to the optical. Æsthetically and optically, no two persons saw external objects alike. The optical, however, more closely approximated than the psychological; yet in relation to the merely optical, "the eye only saw that which it brought with it, the power of seeing," and without the aid of our telescopes and microscopes, worlds, systems, and existences with which we were now generally familiar, and which were far more varied and numerous than those within reach of our unaided vision, would be entirely unknown to us. Mr. Barkas then proceeded to explain the leading properties of light, and showed that the difficulties in relation to the manufacture of optical instruments which Sir Isaac Newton, Wollaston, and others thought insuperable, namely, those of achromatic and spherical aberration, had been almost if not entirely overcome; and we had now microscopes nearly as free from imperfection as was the human eye itself. The eye, however, displayed that peculiar characteristic of all the Almighty's works—it exhibited the largest results with the smallest means, and did, by a modification of one lens, what eight lenses were required to accomplish in our favourite optical instrument. He then proceeded to trace the history of the microscope, commencing with the Assyrian lens, discovered by Layard, three thousand years old, from the date of which till 1590 little progress was made in microscopical manufacture. No microscope really worthy of the name was made until 1660, and even in 1821 no microscope was achromatic. Since that period, Brewster, Airy, Coddington, and others, aided by the practical experience of Rosse, Powell, and Leland, Smith and Beck, and others, had brought the microscope to perfection. Mr. Barkas then drew the attention of the audience to several of the specimens which had been exhibited on the tables that evening, more especially the objects selected from the vegetable world, the first in order

being some living marine diatomaceæ from the sea-shore near Tynemouth, the most remarkable of which were the *Bacillaria cursoria*, which shot backwards and forwards under the microscope like troops moving on parade. Notice was also made of the voloux globator, a constant attraction at microscopical soirées; crystals of fluoride of silicium, closely resembling diatoms; also to several low forms of animal life. He also alluded to some fossil teeth and fossil jaws from the Northumberland coal measures, exhibited by Mr. Craggs. One local naturalist, Mr. Atthey, he said, had devoted much time to the investigation of the fauna and flora of our local coal-fields, and that gentleman was considered to have probably the best collection of carboniferous fossils in existence. The wonderful specimens of diatoms, foramenifera, &c., from the bottom of the Atlantic and other oceans, and exhibited by Mr. Hobkirk, next claimed the attention of and astonished the audience, and the more so as some of the specimens had been brought up in connection with the soundings for the Atlantic cable. After going through several other of the specimens *seriatim*, the lecturer proceeded to say that the microscope was eclectic, and suited all tastes. To the natural philosopher it was one of his greatest boons; and to the most uninquiring, stolid mind, it presented phases of life and passages of natural beauty, of vital and mechanical harmony, that even the most stoical could not refrain from admiring. To the physician it exhibited crystals, cells, and structures which revealed to his experienced eye and mind the seat of disease in a manner no other process of inquiry would so thoroughly recognise. To the chemist it showed under the polarized light the properties of his preparations, which no other means would enable him to detect. To the natural philosopher it opened up forms of skill, beauty, and variety, in every department of nature, which the most romantic, fertile, and ideal mind never dreamt of; peopling every hedgerow and pool with myriad wonders, showing the results of the vital processes that were at work in every living mechanism, culling from the refuse and slime of oceans forms of beauty and diversities of light that transfigured this world into the palace of an enchanter, touching our eyes as with the wand of a magician, and opening them to visions of beauty and treasures more dazzling and gorgeous than the enchanted palace opened by the genii to Aladdin, making us feel that everywhere we walked on holy ground, everywhere were imprints of the Divine fingers on objects too minute to be seen by the unassisted eye of man, and yet under a Great Father's care—He who had seen it good to expend mechanical skill and boundless design upon the flinty shells of innumerable myriads of vegetables, that until very recently had never been seen by the eye of man. All nature literally teemed with life, the result of the Divine outworking. The microscope made or revealed all nature as vocal with praise to its Divine Artificer. What more appropriate could be brought into the

family circle? Amidst the drifting storms of winter and the burning heats of summer, in sickness and in health, in riches and in poverty, the microscope was the endless medium of amusement and instruction. If he were asked what was the most useful single object, as a stimulus to the study of the works of God, that could be put into the hands of an intelligent, observing young person, he would without hesitation answer—the microscope.

ORIGINAL COMMUNICATIONS.

NOTE *on* "ASTERIDIA" *occurring in* PENIUM DIGITUS (Bréb.). By WILLIAM ARCHER.

SOME time ago I made a gathering of some minute algæ from a pool near Enniskerry, on the road going towards Lough Bray. Amongst these a number of globular, densely spined bodies, with green contents, conspicuously presented themselves. The spines densely covering these were very numerous, very slender throughout, and acute. The bodies themselves were mostly to be found distributed in pairs over the field of view. These might easily be taken for so many zygospores of some desmidian; but much as such a structure resembled a possible zygospore, these bodies were not like that known of any species of the family Desmidieæ, nor was there any evidence in the gathering that they might actually be zygospores of any form not yet known in the conjugated state.

Hence, but for an observation made by me on a previous occasion, the source of these curious bodies would have been not a little puzzling.

In a gathering which I had made in the previous year, not, however, from the same locality, I took a quantity of the common desmidian, *Penium digitus* (Bréb.), and a considerable number of them showed, some individuals one, the majority two, and a few three, quite identical stellate bodies in the interior of each cell; these seemed to me evidently to have been formed at the expense of the individual Penium in which they occurred. Some of the Penia showed their cell-contents partially absorbed, and the remainder dead and brown, whilst others did not exhibit a trace of the original contents, but contained the (generally) two spinous bodies, green and vigorous, one in each half of the old cell-cavity of the Penium, the outer wall of which still enveloped them. But afterwards these bodies might be found abundantly without the encompassing old membrane of the Penium, and usually distributed in pairs over the field. (Pl. VIII, fig. 4.)

Now, although in the second instance (the first here mentioned) in which I had found these curious-looking spinous or stellate bodies I was unable to trace them back to a Penium, their identity in appearance in every way, and the fact of their having been found distributed in pairs (as if left behind by the dissolved or decayed outer membrane of a Penium) seems most strongly to indicate that both were one and the same thing, and, in fact, that in both instances these spinous bodies owed their origin to *Penium digitus*.

These bodies are, in fact, the "Asteridia" of the Penium, to adopt Shadbolt's and Thwaites' term as applied to the still enigmatical stellate or spinous bodies occurring within the cells of other Conjugatæ, and, like such similar bodies, these, too, must be regarded, I apprehend, as parasitic growths. These are, indeed, altogether unlike the smooth rounded or irregularly shaped, opaque, brownish, spore-like bodies often seen in various species of Desmidiæ, whose nature continues equally problematical. The latter, indeed, may be possibly related to Chytridium (Al. Br.) or to Pythium (Pringsh.).

In the same gathering I presently noticed likewise a number of slightly smaller green and smooth cells, in some of which a directly transverse well-marked light line could be seen, indicating a commencing self-division. A few such bodies were seen loosely invested by a colourless coat, which coat was externally covered by slender spines; these loose external coats stood off somewhat from the inner spherical, smoothly bounded bodies; the latter afterwards made an exit by a large rent in the spinous outer coat.

Now, Pringsheim records a similar condition in certain "Asteridia" in a Spirogyra,* and I have myself seen the same slipping out by a rent in the spinous outer coat of the Asteridia in a Mesocarpus, and the commencing self-division. Therefore, be the true nature of the so-called Asteridia (Shadbold, Thwaites) what it may, there can be little doubt but that the bodies I describe belonging to *Penium digitus* are of one and the same nature.

Thwaites † and Pringsheim ‡ seem to hold that these bodies are not at all formed at the expense of the contents of the cell of the Confervoid in which they occur, and yet they both seem to regard them as of truly parasitic nature. If the former view be correct, they could not be parasites in the

* 'Zur Kritik und Geschichte der Untersuchungen über das Algen-Geschlecht,' p. 46.

† 'Annals of Natural History,' vol. xvii, p. 262.

‡ Loc. cit., p. 47.

strict sense of the word. But here, in the case in question, though these Asteridia were with green contents, like the other forms hitherto noticed, the fact of the original contents of the Penium seeming to have become in most instances all absorbed, or, if not all absorbed, the residue becoming quite effete and brown, seems to speak for their actual parasitic nature.

It is true that Itzigsohn has sought to establish that these "Asteridia," as well as the very different bodies he calls "Spermatosphæria," are not parasitic, but to be regarded as forming a part of the fructification of the plants in which they occur; that they, in fact, represent the male element, and that their contents exert a fertilising influence on the remainder of the contents of the original cell in which they occur; nay, he even circumstantially explains the process by assuming that the spines are tubules through which permeate whatever the influence may be which is supposed to emanate from the "Asteridium" to the remainder of the contents of the original cell—a curious fertilisation truly, which in *Penium digitus* kills what it acts upon. This fancy seems to find a kind of parallel in Hassal's somewhat similar assumption, that the nucleus in Spirogyra is the male organ, the fertilisation of the parietal contents being assumed by him to be effected in some unexplained way through the agency of the protoplasmic threads radiating therefrom.* But these assumptions need nowadays, I should think, no refutation; Pringsheim has long demolished several of Itzigsohn's hypotheses. The fact is that, while imagination has been largely drawn upon to find a reproductive process in Conjugatæ, the true one has been overlooked and been regarded as simply a fortuitous or insignificant act. Because the process of *conjugation* is so common and so simple, it is ignored, though the many grades and phases, in the various types which it presents, speak loudly, as it seems to me, for an acknowledgment of its true significance.

Although, then, this crude note possesses no value in assisting to throw a further light upon these problematic structures, yet perhaps it may not be considered altogether without interest, for the following three reasons:—(1) That their strictly parasitic nature in this instance seems to be rendered very probable by reason of the destruction of the Penium during their formation; (2) as being the first instance (so far as I am aware) of the occurrence of "Asteridia" in the Desmidieæ; and (3) as being of a form and size not before noted in any of the various Asteridia recorded (fig. 4).

* 'British Fresh-water Algæ,' Intr., p. 6.

So marked, indeed, in appearance are the present examples, and, looking at the same time upon Asteridia in general as parasitic growths, the idea becomes suggested that there may be distinct and constant forms amongst them, and that collectively they ought to form a distinct genus. This suggestion I venture only to throw out; its confirmation or refutation will depend, of course, on time and on a great number of independent observations.

On the Conjugation *of* Spirotænia condensata (Bréb.) *and of* Spirotænia truncata (Arch.). By William Archer.

The two minute unicellular algæ which form the subject of the following brief communication belong to a genus—Spirotænia (Bréb.)—comprising several well-marked forms.

Most of these species are rare. In certain localities, however, the first species now in question, *Spirotænia condensata* (Bréb.), is common; the other, *Spirotænia truncata* (mihi), belongs to the most rare, having been, so far as I am aware, found only by myself, and that in but one locality ("Feather-Bed" Mountain). But it is not to be understood, as regards *Spirotænia condensata*, that any waters may present this pretty species, for it must be sought for in suitable situations; then, indeed, it is frequently encountered.

But often as *S. condensata* presents itself to notice, distributed, as it appears to be, in Europe, and familiarised, as we cannot fail to be, with this the commonest and at the same time the most beautiful representative of its genus, both it and its congeners, have hitherto resolutely refused to reveal to us its mode of fructification or reproduction. Yet all the species are very constant to their characteristics, and one could not resist the feeling, as regards them, unlike, perhaps, many of the simple plants, that they must prove to be truly *sui generis*.

It is true, indeed, that *à priori* we would be justified in assuming that the mode of reproduction in this genus, like that of Spirogyra, &c., when found, would be seen to be by conjugation, and hence the genus has been by most authors referred to the Desmidiaceæ; nevertheless, pending a knowledge of the actual process from direct observation, the true position of the genus has remained hitherto in doubt. Thus

only the other day, in Reinsch's lately published work on 'The Freshwater Algæ of Franconia,'* it is stated by that writer—"The position of the Spirotæniæ in the system is still very uncertain; they belong, with Eremosphæra, most probably to the Palmellaceæ." Again, in de Bary's work on the Conjugatæ, as regards this genus, he states—"On account of the fructification being unknown, the position of the entire genus is not quite certain." †

That this genus should be relegated to the Desmidiaceæ will, I think, be considered proven from the following description of the conjugated state, as it differently presents itself in two distinct species, now for the first time recorded, and this notwithstanding Reinsch's views expressed on the conjugation in Palmoglœa,‡ a genus he still retains, notwithstanding de Bary's beautiful researches.§

Before, however, proceeding to describe the conjugation of *S. condensata*, it would seem to me to be desirable to draw attention to the seemingly noteworthy fact that in this species the nucleus is parietal, not central. It forms a somewhat large elevation, rounded on one side and straight on the other, the convex side projecting into the cavity of the cell and gradually sloping off all round, and its flat side towards the wall; it is ordinarily placed equidistantly from either end of the Spirotænia. It has imbedded in the very centre a minute, light-coloured, distinctly marked nucleolus. The broad spiral band of endochrome, in making its revolutions, twice underlies the body of the nucleus, which fact will convey an idea of the extent of space covered by its flat side. The nucleolus always occupies a position just over the vacant interval between the two parts of the spiral band which underlies the nucleus, thus the more readily disclosing itself to view, as there is there no chlorophyll-mass intervening to obscure or hide it.

The figure described for the nucleus is, of course, that presented by it when seen from the side; when seen from above or below it naturally offers a rounded outline, and might then be readily taken as a globular and central nucleus.

It must be noted, however, that this characteristic of the nucleus is plainly to be seen only in specimens kept for some time in the house; in such examples the band of endochrome becomes much more sharply defined, with a smooth edge, like

* 'Die Algenflora des mittleren Theiles von Franken,' p. 203.

† 'Untersuchungen über die Familie der Conjugaten,' p. 75.

‡ Reinsch, op. cit., p. 202.

§ De Bary, op. cit., p. 30.

a little ribbon—those granules, which ordinarily are more or less scattered, and which thus tend in a certain degree to obscure the actual characteristic spiral arrangement of the endochrome, seem then to be absent—then the nucleus and its nucleolus come out to view in perfection. Indeed, it is hardly possible to see a more elegant object than a favorable specimen of this handsome species, which shows the nucleus in side view and the light so shed from the condenser as to fully illuminate the whole cavity and clearly to display its characteristic and beautiful arrangement.

I have not yet been able to detect a nucleus in any other species of Spirotænia; perhaps, as in *S. condensata,* it requires favorable circumstances to reveal it. I am, however, the more desirous to draw attention to it as it exists in the species under consideration, inasmuch as it forms a seemingly noteworthy exception to other Desmidiaceæ in this regard. In all other species in which the nucleus can be seen it is orbicular and central; nor does de Bary, in his work on the Conjugatæ, draw attention to the peculiarity in this species which I have pointed out—nay, his figure* leads to the idea that he regarded the nucleus as central; but this may, indeed, arise from his having seen and drawn it either from above or below, and not from the side, which, as I have shown, would be deceptive.

Another reason which causes me to think it advisable that attention should be drawn to the form and position of the nucleus in this species is the possibility that observers might imagine, upon casually viewing an example, that it perhaps represented nothing but a detached joint of a Spirogyra. Such a mistake, indeed, I could hardly imagine possible when sufficiently closely examined; but even if it *be* possible, I think, due regard being had to the circumstance that the nucleus in *Spirotænia condensata* is semiorbicular and parietal, whilst in Spirogyra it is equally compressed and central, ought at once to preclude the chance of any confusion.

To pass on to the conjugated state.

When I first examined the gathering, in which this species occurred more than usually copiously, my attention was attracted by the number of cells lying side by side over the field of view in parallel pairs. Under such circumstances it is always well not to lose sight of the specimens of whatever species may be so encountered, as it betokens impending conjugation; accordingly I placed these aside for further observation. Nor was there any disappointment in this case.

The following is the process:

* Op. cit., t. v, fig. 12.

Shortly the cell-contents of each opposite parent-cell so lying side by side become separated into two portions, which by degrees become more and more contracted into a shorter and shorter elliptic mass. As the contraction of each half of the contents of each cell advances, the spiral arrangement becomes more and more obliterated, until finally there is little or no trace left of the original spiral band. (Pl. VIII, fig. 5.)

It is to be regretted that the observation is here insofar incomplete that I can give no record of what becomes of the nucleus during this process. Even though it became divided along with the separation of the cell-contents into two portions, and were there actually a new nucleus in each half, it could not be indeed now seen, as the green contents become so much more densely packed than when, as a spiral band, they occupied the whole cavity of the parent-cell.

The outer wall of the parent-cell, now enclosing the two elliptic masses of contents, is still to be seen (fig. 5); it is thin, and hardly presents a double contour. By degrees it seems to get more and more faint, vanishing finally, probably by solution.

Now begins the conjugation. Each elliptic mass derived from one of the parent-cells passes over and becomes conjugated by complete fusion with the corresponding opposite portions derived from the other parent-cell (fig. 6). That is, although the two portions of each original parent-cell may now be regarded as physiologically distinct sister-cells, being in fact daughter-cells without a special wall, they do not conjugate with each other, but with the respective halves or daughter-cells opposite to them. In other words, regarding the original parent-cells as placed side by side vertically, the upper half of the contents of the left-hand cell becomes conjugated with the upper half of the contents of the right-hand cell, whilst simultaneously therewith the lower half of the contents of the left-hand cell becomes conjugated with the lower half of the contents of the right-hand cell. Consequently, in every case of conjugation in this plant there are two zygospores formed, the four masses having become mutually amalgamated into two.

At an early stage each zygospore becomes surrounded by a *halo* of mucus, which by degrees seems to become more and more dense and more definitely bounded. Each nascent zygospore, at first of a more or less irregular figure-of-eight shape, finally wholly coalesces to a spherical form; and each then acquires a definite, smoothly bounded cell-wall, the contents being densely granular (fig. 7).

Now, if observation ceased here, we should have but an

inadequate and imperfect idea of the ultimate characteristics of these pretty and singular zygospores. On keeping the specimens it was found that they were not destined to remain, like the zygospores of some species, absolutely smooth, and without external decoration. Presently there begins to arise what seems to be a kind of border of short linear spines, when an optical section, as it were, is brought into focus (fig. 8). But a more close examination shows that this is not a covering of spines, but the beginning or basis of a honeycomb-like structure all over the surface of the zygospore, and the spine-like lines are merely the angles of the cells of the "honeycomb" structure, a little thicker than their walls. By degrees this honeycomb structure rises and enlarges; its cells become deeper and deeper; then the walls of the cells of the "honeycomb" become a little rounded externally, and each zygospore is complete (figs. 9, 10).

By focussing an empty cell-wall of a zygospore, one can see down into the cavities or "cells" of the "honeycomb" structure at that part of the globe nearest to the observer, and by degrees more and more obliquely as they pass round to the circumference, where they are, of course, as in the zygospore retaining its contents, seen sideways (fig. 11). By describing this remarkable structure as "honeycombed," I do not mean to infer that the cells, or cavities, or interspaces, are always hexagonal; they are, indeed, more or less irregular, being three, four, five, or six-sided.

Thus, the conjugated state of this most marked species presents two noteworthy characteristics—one the doubly formed, as it were twin, zygospores; the other the remarkable "honeycomb" structure externally decorating them. The doubly formed or twin zygospores have their parallel in a very few instances only, such as *Closterium lineatum* (Ehr.), and *Closterium Ehrenbergii* (Menegh.). In these the conjugation of the parent pair of cells gives rise to two spores, not one only, as in by far the overwhelming majority of instances. But, though so far agreeing with the species mentioned, there are differences of detail, as is seen, proper to the species now in question.

In the second circumstance, the "honeycomb" structure, this plant is, so far as I know, absolutely unique.

Indeed, these zygospores could not possibly in themselves be mistaken for any other unicellular vegetable form that I know of, if examined with any degree of attention. Viewed under a moderate power, there is just a possibility of the curious "asteridium" recorded by me, appertaining to *Penium digitus* being confounded with it (fig. 4). The densely

arranged short, linear spines of that structure form to the eye a kind of border, which momentarily might be thought to resemble the border produced by the honeycomb structure on the zygospores of *Spirotænia condensata;* and the bodies themselves are, moreover, much about the same size. The prevalent occurrence in pairs, too, of the former, after the original wall of the Penium has disappeared, might help to lend them a further resemblance. But I need hardly insist on their wide distinctions when carefully viewed, yet it is, perhaps, not quite out of place to draw attention to these very different structures simultaneously.

As regards the second species of Spirotænia which it has been my good fortune to find conjugated, *Spirotænia truncata* (mihi),* I regret that I cannot give any account of the early stages of the process. I am only in a position to offer a figure of the fully formed zygospore. Here, as in by far the most of the Desmidieæ, there is one spore only formed. It is, however, of a novel form, so much so as that I feel satisfied it could not be mistaken for that of any other species whatever yet known, nor for any other described unicellular structure. The zygospore here is equally lobate, the lobes or projections being of a triangular or conical outline, the apices subacute; there are no spines; the tint of the cell-membrane appears to be of a kind of straw colour, and the contents seem to form a globose mass in the centre, leaving the angular lobes void. The four empty halves of the pair of parent-cells seem to remain loosely appended, each pair diametrically opposite to the other, the zygospore between (fig. 12).

As regards the plant itself in the unconjugated state, I might mention that the cells seemed to be somewhat more minute than when I saw it on the first occasion; also the spiral band was rather more narrow and definitely margined, and sometimes appeared to branch or subdivide, and the enveloping gelatinous envelope was less marked. The latter circumstances might, perhaps, be accounted for, as in *S. condensata*, by the gathering in which they were detected being for some time in the house. But though the spiral band was more sharply defined, and any scattered granules likely to impede the view into the interior of the cavity of the cell were likewise fewer than when I previously had seen this species, I was yet unable to perceive a nucleus satisfactorily. The narrow truncate extremities and the characteristic little space in each, now with one still darkish granule,

* 'Proceedings of the Natural History Society of Dublin,' vol. iii, p. 83, pl. ii, figs. 29—31; also 'Quarterly Journal of Microscopical Science, N. S., Vol. II, Pl. XII, figs. 29—31.

were there as before, which, combined with the solitary band of endochrome and the cylindrical figure, tapering towards the ends, rendered it without doubt that it was one and the same plant. I was much pleased, therefore, to find this very distinct species a second time after so long an interval, especially in the conjugated state, forming, indeed, the second known instance of conjugation in the genus.

I have alluded to the recent work of Reinsch, in which he denies to "*Palmoglœa macrococca*" (Kütz.)—more properly, surely, regarded as a species of Mesotænium—a place amongst Desmidiaceæ, and this because he believes the plan of conjugation in that plant to hold a middle place between that of a typical Desmidian and the Zygnemaceæ. He holds that each parent-membrane of the conjugating cells of Mesotænium (which, notwithstanding the heterogeneous and incongruous character of Kützing's genus Palmoglœa, he stills calls by the latter name) actually takes a share in the formation of the zygospore itself, nay, even that the two coalesce so as to form its special membrane, and that hence it cannot be placed with Desmidiaceæ on the one hand nor with Zygnemaceæ on the other. At least, then, a place in the Desmidiaceæ could not be refused to *Spirotænia condensata* nor to *S. truncata* on the same grounds. Here, manifestly, the parent-membranes take no share in the formation of the zygospore, not even so much as to form a connecting canal, as in Spirogyra or Zygnemaceæ generally. But, though it may be in a measure apart from the subject proper of this communication, I cannot refrain from expressing my conviction that Reinsch is in error in the view he expresses as regards the process of conjugation in Mesotænium (*Palmoglœa macrococca*, Kütz.). I venture to say that here the membranes of the parent-cells do *not* take a part in the formation of the zygospore, but that during the conjugation they are gradually thrown off, and probably become dissolved and help to increase the surrounding gelatinous matter. They, in fact, come away, leaving the contents to become mutually fused, quite as they do in Penium or in Cylindrocystis, only they are more fugitive. See on this point De Bary's figures* in Mesotænium as well as Cylindrocystis, which genera, along with some others, as well as some as yet uncertain forms, make up the old incongruous genus Palmoglœa (Kütz.). I venture to think that Reinsch, the next time he examines some of these plants

* 'Untersuchungen, &c.," t. vii; also my own communication, 'Proceedings of the Natural History Society of Dublin,' vol. iv, p. 12, pl. i, figs. 8—14, Mesotænium, and 35—44, Penium; also 'Quarterly Journal of Microscopical Science,' Vol. IV, N. S., p. 109, Pl. VI.

during conjugation, will be readily able to satisfy himself on this point.

That, as in other Desmidieæ, the new growth, in Spirotænia during self-division, is produced between the two older halves, seems evidenced by the blunt extremities as seen after division, and by the varying position of the nucleus as regards the extremities. The genus Spirotænia, in fact, seems as truly to belong to Desmidiaceæ as do Penium, Cylindrocystis, or Mesotænium; the place, in fact, which has been assigned to this genus so long, even though it were but provisionally, seems to be its legitimate position, sustained as that view is by the fact, now here for the first time recorded in two species, that its fructification takes place by conjugation.

Another Interpretation *of* Dr. Moxon's Discvoery. By J. Gedge, M.R.C.S.

In the number of this Journal for October, 1866, Dr. Moxon brought forward a valuable paper on the distribution of the antennal nerve in a Culex larva. The value of this paper, to my mind, however, consisted in the accurate account and delineation he gave us of what he saw. With Dr. Moxon's observations I find no fault, but with his conclusions I cannot agree. On these latter I had hoped that some more able and better-known observer than myself would have come forward and given his opinion; but as the last number of the Journal was silent, I feel bound to show that consent to his views is not universal—that his observation may bear another interpretation.

Dr. Moxon supports Kühne's views on the termination of motor nerves, and he seems to consider his observation on this dipterous larva quite a convincing fact, which will prove for ever the disputed point concerning the peripheral termination of motor nerves. He thus states his conclusions :—

"The nervous contents of the neurilemma are, then, continuous with a pellucid material disposed along the same side of the fibre, between the sarcous substancs and the neurilemma."

Though here Dr. Moxon only mentions the "pellucid material," elsewhere he tells us of certain "nuclei in the space between the edge of the sarcous substance and the sarcolemma." And he ends his paper by saying that this single "proof" (*i. e.* the observation of an insect larva) is

sufficient, for "no one can doubt that muscle and nerve, universally identical in their construction, have an equally universal identity in their manner of connection."

Dr. Moxon, then, believes that the nerves of insects are formed on a similar plan to those of the higher animals, but his admirable drawing shows that he is no more able to prove this fact than other observers.

His nerve-trunks are represented as homogeneous in structure; still, it appears he believes them to be bundles of fibres. Again, his ganglion is a mere mass of ganglion-corpuscles; but he is bound to believe that every one of these corpuscles has fibres in connection with it, as we find to be the case in the higher animals. In my own observations on the minute anatomy of insects, I cannot claim to be in advance of Dr. Moxon. In Hymenoptera I have traced the nerves from the ganglionic columns, branching and rebranching again and again, have followed extremely small branches into and through the ganglia of the sympathetic system, but never have I been able to see what I believe to be actual nerve-fibres, or to detect any relation between the fine nerves and the ganglion-cells, except that of contiguity. Still, from the fact of the nerve-trunks branching in an exactly similar manner to what we observe in higher animals, I feel sure that these nerves are made up of fibres which probably never branch, except at their terminal distribution. And I have no doubt that the ganglion-corpuscles, so similar in appearance to those of the frog, though differing considerably in size and texture, have nerve-fibres connected with them; but though I have been able to demonstrate this connection in the frog, I have been unable to see any similar arrangement in the insect.

Now, it is to me surprising that any one who cannot see that the nerve-trunks are bundles of nerve-fibres, but only define the outline of their sheath, should know when he is looking at a nerve-fibre. It is true that Dr. Moxon never speaks of a *nerve-fibre*; he is careful not to commit himself. And so he only makes use of the collective or general term—nerve. But it is impossible that Dr. Moxon can believe in the sudden termination at one point of a whole bundle of nerve-fibres, and therefore I take it for granted that he uses *nerve* in the sense of *nerve-fibre*.

The nuclei and the "pellucid material" are said to be within the sarcolemma, and are represented in the drawing between the muscular fibre and its puckered sheath. These nuclei are so accurately delineated, that I was at once able to recognise them as nuclei with which I was familiar; but I

have never seen them within the sarcolemma. Neither have I ever seen the sarcolemma become puckered around a contracted muscular fibre. Sometimes a fibre shrinks within its sheath, and has a wavy appearance; but then the sarcolemma may be seen tightly strained, spanning across the concavities of its undulating margin. The sheath described by Dr. Moxon as the sarcolemma is in reality the fascia of the antennal muscle.

Fasciæ, composed of a connective tissue, do exist in the muscles of insects. Let any observer obtain a pupa of one of the Sphingidæ for instance, and this he can do without waiting until the spring.* Then, having removed the upper half of the abdominal part of the pupa, and cleaned away the fat from it, he will see four dorsal segment-muscles. Soak these in water, or, better still, in glycerine containing two or three drops of acetic acid to the ounce, or prepare them with a slightly alkaline solution of carmine. The objection, however, to this latter method in this particular, is that the time required for soaking is sufficient to allow the fluid to drive the air out of the trachea, and then the nuclei, which by this method I am always able to demonstrate at regular intervals along the tracheal sheath, would lead to confusion and misunderstanding. When prepared, detach one of these muscles from its anterior and posterior attachment, and it will be found to separate at once into a number of distinct fasciculi. These contain a variable number of muscular fibres bound together by extremely delicate tissue, corresponding in position to the connective tissue of higher animals. Beneath this delicate investment, but outside the sarcolemma of the contained fibres, nuclei precisely similar to those described by Dr. Moxon may be demonstrated. The tissue which invests these fibres and glues them together, though here it has no certain structure, is, I believe, true connective tissue, modified in structure only in proportion to the modifications observable in other tissues. Every muscle in the insect, and every fasciculus, whatever the number of contained fibres, has its fascia.

These nuclei, though they lie along the edge of the muscular fibres, are often very numerous, and, if carefully examined, may be seen to be on different planes. Why they should generally be visible only along the edge of the muscular fibres is not easy to see, but doubtless it arises in part from the difficulty of seeing them when they are backed by the muscle, and partly in consequence of these gibbous nuclei being disposed in an almost diffluent medium, the slightest pressure

* This paper was written in the beginning of January.

slides them over the sides of the fibres. Now, although I have at present been unable to prove that these nuclei belong to nerve-fibres, still for some time past I have believed them to be, and Dr. Moxon's observation has done much towards strengthening my opinion.

The soft, almost pulpy, texture, or, more correctly, consistence, of the tissues in insects compared with those of the higher animals shows them to be unfitted for tracking the course of nerve-fibres. The muscular tissue is modified in proportion to the modification in the connective and nervous tissue. No one can fail on comparison to see the great difference between the muscular fibre of a vertebrate animal and that of an insect, though at first sight the transverse markings on each are apt to mislead. The difference in substance of the garglion-cells is also considerable. Often on the slightest pressure these cells take a distinctly polygonal form from mutual pressure, while in the higher animals they always remain nearly spherical.

Those who have not made up their minds as to the termination of nerve-fibres, but stand as lookers-on at this controversy, ought to be careful how they receive those observations which from time to time appear. When a man comes forward and declares "I have found the termination of a motor nerve," it behoves us to look carefully into his method of research. Now, it is well known that Kühne and his disciples, who declare that they have seen *nerve-ends,* go the right way to work to produce such appearances. Nitric acid of the strength Kühne uses it is quite sufficient to destroy the capillary nerve-fibres of Beale. That these capillary nerve-fibres do exist, I have the strongest evidence, for, by following Dr. Beale's delicate method of preparation, I have demonstrated these nerve-fibres most perfectly; so perfectly, indeed, that I could not convince myself, until I had showed my preparations to Dr. Beale, that these decided nerve-fibres were the fibres unseen by Kühne, but vaguely declared by him to be fibrous tissue—a mistake he could not possibly have made had he been acquainted with the appearance of fibrous tissue when thus prepared.

Some, then, by rough usage destroy the finer nerves of the higher animals, while others think they have found the termination of individual nerve-fibres in animals where the nerve-fibres themselves have not yet been demonstrated. These, then, are the points in which I differ from Dr. Moxon:

1. The tissue known as connective tissue does exist in insects.

2. The antennal muscle has a fascia composed of this tissue, and this sheath Dr. Moxon has called the sarcolemma.

3. The antennal nerve has a similar investment, known as the neurilemma.

4. The neurilemma of the antennal nerve is continuous with the fascia of the antennal muscle.

5. The antennal nerve is a bundle of nerve-fibres.

6. The nerve-fibres which are undefined within the neurilemma remain undefined after they have left that sheath.

7. The "pellucid material" is the mass of nerve-fibres.

8. The individual fibres, after they have left this pellucid mass, have not been demonstrated.

9. The nuclei are probably the nuclei of nerve-fibres.

10. The antennal nerve breaks up and is distributed within the muscle-fascia, but not within the sarcolemma.

On the Protophyta *of* Iceland. By W. Lauder Lindsay, M.D., F.R.S. Edin., &c.

When we consider the geographical position of Iceland, the extent of its traffic with Britain and Scandinavia, the abundance of the localities which it contains affording suitable habitats for such forms of vegetation, it is not a little remark- to find its *Flora* extremely defective in some of its departments, and notably so in that of the *Protophyta* and the lower or *Chlorospermous Algæ*.

Iceland has been for years in constant and regular communication by steam (during the spring, summer, and autumn months, at least) with Denmark and Britain.* The island belongs to Denmark, a country which possesses most zealous and accomplished naturalists; it has been repeatedly visited by Scandinavian, French, and other continental men of science; and has been the field of at least one Natural History Expedition, the fruits whereof have been published in a series of magnificent volumes.† It is now one of the fashionable summer excursion-fields of British naturalists and tourists, who have during the last ten years published

* "Iceland a new Field for Tourists," 'Perthshire Advertiser,' Aug. 2nd and 9th, 1860.

† 'Voyage en Islande et au Gröenland executé pendant les années 1835 et 1836 sur la Corvette *La Recherche;* publié par ordre du Roi sous la direction de M. Paul Gaimard, Président de la Commission Scientifique d'Islande et de Gröenland.' 6 vols. folio, with an atlas, Paris, 1840.

many works of travel in Iceland, containing sections or chapters devoted to its natural history;* and it has been visited by British botanists of such distinction as the late Sir W. J. Hooker, of Kew, and the present Professor Charles Babington, of Cambridge. Its geology and mineralogy have been the subjects of some elaborate treatises; its birds and their eggs have had several zealous students and collectors; not a few travellers have made superficial gatherings of phænogamous plants; but our knowledge of the groups of Cryptogams here referred to is meagre and unsatisfactory in the extreme. I propose here to show how meagre, especially for the information of *British* naturalist-tourists, in the hopes that *they* may be stimulated to undertake at least what is the comparatively easy work of *collection*.†

I. *Diatomaceæ.*

In a 'Flora of Iceland,' ‡ which I published in 1861, and which included all plants up to that date recorded as having been collected in that most interesting island, only one Diatom was mentioned; and even yet I am enabled to subjoin a total list (which follows) of only ten species, some of which, moreover, are *fossil:*

1. *Isthmia nervosa,* Kütz. (*I. obliquata,* Ag., in my 'Flora,' p. 36). Occurs also on the coast of Denmark, England, and Portugal.
2. *Amphora Libyca,* Ehrb. Libya, America, and some parts of Central Europe.
3. *A. Semen,* Ehrb.
4. *Navicula æqualis,* Ehrb. Occurs also in other parts of Northern Europe.
5. *N. constricta,* Ehrb. Fossil.
6. *Stauroneis aspera,* Ehrb. Occurs in various parts of Europe, from Spitzbergen and Norway to Corsica and Sardinia.
7. *S. Liostauron,* Ehrb.
8. *Grammatophora Islandica,* Ehrb. On the coasts.

* Since my own visit in 1860, works of travel have been published almost annually by British tourists of the "Alpine Club" class (*e.g.* by Symington, Forbes, Metcalfe, Gould, Shepherd). None of these, however, are so scientific and of such permanent value as a German work published by two of my *compagnons de voyage* of 1860, Professor Zirkel, of Lemberg, Galicia, and Dr. Preyer, of Berlin, viz., "Reisenach Island im Sommer 1860," Leipzig, 1862.

† Many remarks on the subject of *collection,* especially of the *Diatomaceæ,* will be found in my previous paper, "On the *Protophyta* of New Zealand," in this Journal, April, 1867, p. 97.

‡ 'Edinburgh New Philosophical Journal,' July, 1861, and 'Transact. Botanical Society of Edin.,' vol. vii, p. 114.

9. *Campylodiscus Kützingii*, Bail.
10. *Eunotia bidens*, Ehrb.* Fossil in Oldenburg (Prussia).

There can be no doubt that this is a terribly inadequate representation of the Diatoms of a country, which cannot fail to be rich in them. Quite recently, while examining some fragments of a *Conferva* from the *hot* springs of Laugarness, near Reykjavik, Dr. McNab found species of at least six different genera (viz., *Cymbella, Epithemia, Stauroneis, Pinnularia, Synedra,* and *Gomphonema*);† and he remarks on their identity in many cases with Scottish forms that inhabit *cold* waters. From the same hot spring I brought home, in 1860, specimens of *Confervæ*, which I sent to Dr. Greville, and which must have abounded more or less in Diatoms; but I never heard the result of his examination, if he did examine them at all. In Iceland, thermal waters of all degrees of temperature abound; and they are characterised by the large amount of silica they hold in solution, and by the extent of their siliceous deposits.‡ The abundance of Diatoms in the thermal waters of Central and Southern Europe warrants us in expecting large additions to the Icelandic Diatomaceæ from this source alone. But rivers and streams, shallow lakes and extensive marshes, also abound—habitats which are generally fertile in Diatoms in other parts of Northern Europe, and of the world generally. Moreover Diatoms occur in the ejecta (dust, ashes, sand) of the volcanoes—extinct or active—of Southern Europe and other parts of the world, and these ejecta are abundant in Iceland. The Palagonite and other tuffs

* The list of species here given is cited as Icelandic on the faith of Dr. Rabenhorst's 'Flora Europæa Algarum Aquæ Dulcis et Submarinæ,' Leipzig, 1864-5, which comprises the *Diatomaceæ* and the *Phycochromaceæ* (the latter including the *Chroococcaceæ*, the equivalent of the *Palmellaceæ* of the older authors, and the lower *Chlorospermous Algæ*, viz. *Oscillariaceæ, Nostochaceæ, Rivulariaceæ, Scytonemaceæ,* and *Sirosiphonaceæ*). The work is a most comprehensive one, exhibiting great labour in compilation, and probably representing fairly, as it professes to do, the present state of our knowledge of the distribution of these organisms in Europe. It is impossible, however, to place implicit confidence in his citations of *localities;* for, in regard, at least, to Scottish species, he has fallen into several important errors. For instance, he records Lismore (Carmichael) as in Iceland; and Braemar, Killiecrankie, Cumbrae, and the Frith of Clyde, as in England!

† "Notice of some Diatomaceæ from Iceland," 'Proceed. Botan. Society of Edin.,' February 14th, 1867.

‡ This is shown by the results of analyses of the hot-spring waters and deposits brought home by me in 1860, as published in my paper "On the Eruption in May, 1860, of the Kötlugjá volcano, Iceland," 'Edin. New Philosophical Journal,' January, 1861, p. 18. *Vide* also "Contributions to the Natural History of Volcanic Phenomena and Products in Iceland," 'Proceed. Royal Society of Edin.,' December 17th, 1860, vol. iv, p. 387.

of Southern Europe also contain fossilised Diatoms, and these rocks are also very largely distributed in Iceland.* It is unnecessary further to indicate the probable habitats of Diatoms in Iceland. Sufficient has been said to show that there are few portions of Northern Europe more likely to prove prolific in Diatomaceous vegetation when this shall have been duly studied. There cannot fail to occur in Iceland a proportion at least of those Diatoms, which have been found commonly and widely distributed throughout Europe, or in Northern Europe, or in the North-Sea bed; along with others of a more northern type or distribution. I see no reason to doubt, indeed, that the Diatomaceæ alone yet to be detected in Iceland will exceed in number the whole of its *Algæ*, marine and freshwater, as given in my 'Flora' of 1861. The result† of my very superficial gatherings from a most limited area in New Zealand (110 species of *freshwater* forms alone, all new to the New Zealand Flora) ought to encourage even tourists to undertake the work of collection, for in New Zealand, as in Iceland, I was myself but a passing traveller.‡

II. *Desmidiaceæ.*

III. *Palmellaceæ* (*Chroococcaceæ* of Rabenhorst).

I know of no record of either *Desmidiaceæ* or *Palmellaceæ* proper in Iceland, except the following solitary representative of the latter—*Aphanocapsa Grevillei,* Hass. (*Coccochloris Grevillei,* var. *botryoides,* Hass., of my 'Flora,' p. 36)—which occurs throughout Germany, Holland, and England; while the following very short list includes all the—

IV. *Chlorospermous Algæ.*

I have found on record—

1. *Nostochaceæ.*

1. *Nostoc*§ *commune,* Vauch.

Occurs throughout Europe.

* Palagonite tuff is regarded by geologists as of aqueous origin, and partly, at least, a mud deposit of thermal waters. Remarks on volcanic tuffs and various so-called "infusorial earths," in relation to their Diatomaceous contents, will be found in my paper on Kötlugja, p. 20.

† As it is recorded in the last number of this Journal, p. 97.

‡ It should be a further source of encouragement to tourists that a hasty and superficial collection of *Lichens* made by myself in 1860 from a most limited area around Reykjavik exceeded in the number of species the whole catalogue of the Icelandic Lichens as known up to that time; while it also added many species to the said catalogue. (*Vide* "Contributions to the Lichen-Flora of Northern Europe;" 'Journal of Linnean Society,' "Botany," vol. ix, p. 393.)

§ Some recent writers transfer this genus or some of its species, which

2. *N. verrucosum*, L.

Throughout Europe, North America, and New Zealand.

3. *N. lichenoides*, Ag.

Throughout Europe.

2. *Oscillariaceæ.*

1. *Oscillaria* (*Oscillatoria* of older authors).

O. tenuis, Ag. Distributed throughout Europe; occurring at Plombières, Aix, and Dax, in thermal waters.

2. *Phormidium vulgare*, Kütz., var. *myochroum*, Kütz.

(*Oscillatoria, autumnalis*, Ag., of my 'Flora,' p. 36.) Throughout Europe.

3. *Chthonoblastus repens*, Kütz.

(*Microcoleus*, Harv., of my 'Flora,' p. 36.) Throughout Europe.

3. *Rivulariaceæ.*

1. *Zonotrichia atra*, Lyngb.

(*Rivularia*, Roth, of my 'Flora,' p. 36.) Marine; coasts throughout Europe.

2. *Gloiotrichia angulosa*, Roth.

(*Raphidia* Hass., of my 'Flora,' p. 36.) Throughout Europe.

Certain genera of the *Nostochaceæ* are widely distributed, and are very abundant in the Arctic regions and other parts of the world. They frequently give a predominant tint to large masses of water; for instance, in lakes in mountainous countries such as Scotland and Switzerland.

Some genera or species of the *Oscillariaceæ* are cosmopolite.* They mostly inhabit fresh water, or grow on moist or wet shady rocks, such as those about waterfalls or springs, in ravines or gorges—in localities, that is, which are also frequented by *Hepaticæ*. The commoner forms constitute a slime on the rocks or surfaces on which they occur. They are also partly marine, the marine forms being the largest. One of the marine genera is of very peculiar habit, forming a scum on the surface of the sea for many miles. Some species also give a peculiar tint to large masses of fresh water, as the *Nostochaceæ* do; they are common in hot springs. Sometimes, like certain *Lichens*, they are found on bleaching bones.

in Europe alone amount to about sixty, to the *Lichens*. The absence of apothecia and spores is, however, a serious obstacle to its ranking as a *Lichen*-genus.

* The genus *Oscillaria* occurs in latitude 75° 49′ north.

Occasionally, their altitudinal range is considerable, as they ascend to 17,000 or 18,000 feet on the Himalayas.

The *Confervaceæ* are an immense tribe, whose genera or species are more or less plentiful in a great variety of habitats in all parts of the world. The lower or smaller forms have generally the widest geographical range, and ascend to the greatest altitudes (17,000 to 18,000 feet on the Himalayas). They abound on the Antarctic Islands. *Confervaceæ* occur equally in salt, brackish, and fresh water; in hot springs; on soil and rocks however bare, when sufficiently moist and shaded; and on various aquatic plants. Generally speaking, the branched marine species are the larger, but some of those which occur in mountain streams are also very long and filamentous. Not infrequently, the freshwater forms occur on the surface of stagnant water in masses so dense and so closely packed that they have obtained and deserve the name of "water-flannel" or "water-paper." A similar mass, which sometimes resembles a coarse textile or felted fabric or paper, appears occasionally on flooded ground. Some genera or species contain, like various higher (Rhodospermous) Algæ, considerable quantities of calcareous matter, which obscures or complicates their botanical character.

The *Batrachospermeæ* constitute a small group of delicate and beautiful forms. The typical genera and species are mostly confined to the northern hemisphere, though some are cosmopolite or are very widely diffused. Certain species, as in the *Confervaceæ*, contain a considerable amount of calcareous matter. The species of the genus *Batrachospermum* are natives of fresh water, with the exception of one, which inhabits the sea.

Of the *Siphoneæ*, some genera and species affect sandy shores, others rocks above or below high-water mark, or exposed only to the sea-spray; others, again, inhabit deep water. Some are confined to warm, but others to cold, climates. The *Vaucheriæ* are widely distributed, occurring both in the southern (Kerguelen's Land, New Zealand), and northern, hemispheres. They frequently abound in pools about waterfalls, and on damp soil or mud. Like so many of the lower Algæ, they exhibit a wonderful power of resisting extremes of temperature.

We have seen, then, that many of the *Chlorospermous Algæ* are ubiquitous—that they abound in Arctic and Antarctic, as well as temperate and tropical, climates—that they ascend to great elevations—that they occur in waters of all kinds and temperatures, as well as in a great variety of other habitats. Moreover, Rabenhorst's and other works show how plentiful

they are throughout Europe, including Scandinavia and Britain; and yet so recently as 1861 the Flora of Iceland contained, and apparently still contains, only three species of *Nostoc* representing the *Nostochaceæ;* three species of the *Oscillariaceæ;* two of the *Rivulariaceæ;* three of the *Zygnemaceæ;* nine of the *Confervaceæ;* and none of the *Siphoneæ, Batrachosphermeæ,* or *Hydrodictyeæ.**

I feel assured that these figures represent only the merest fraction of the *Chlorospermous Algæ* of Iceland, and that, indeed, this department of the Icelandic Flora remains as yet *virtually unexplored.*

The freshwater Algæ are, however, much more difficult to preserve in a proper condition for determination than the Diatomaceæ, whose siliceous skeletons or cases effectually protect them for all time. The freshwater Algæ, and especially the *Confervaceæ,* I brought from Iceland in 1860 were found, on unpacking them at no long interval, in a state quite unsuited for identification by the most experienced algologists; and similar was my experience in regard to my New Zealand collections of the same group of organisms in 1861.† These delicate groups of Algæ should, indeed, either be examined *on the spot*, or be preserved with special care. No doubt it is owing to this difficulty in preserving them that so little, comparatively, is known of this interesting and large group of Algæ in such countries as Iceland and New Zealand.

My 'Flora' of 1861 further shows that the *Fungi*—especially the lower orders—are almost equally comparatively unknown in Iceland; and to a certain extent the remarks just made in regard to difficulty of preservation, and the desirability of study on the spot, in the living or fresh condition of the plants, apply equally to the Icelandic Fungi. The result of my New Zealand collections in 1861 was that, as in the case of the Chlorospermous Algæ, there was a large proportion of genera and species unfit for determination.‡

* Among the immense number of species constituting his *Phycochromaceæ*, Rabenhorst so lately as 1865 gives not a single Icelandic citation!

† "On New Zealand *Algæ*." 'Trans. Botan. Society of Edin.,' vol. viii, p. 420.

‡ "On New Zealand *Fungi*." 'Trans. Botan. Society of Edin.,' vol. ix, p. 13.

On a Larval Form *of* Insect.
By C. Tomes, Esq.

We have received a very interesting communication from Mr. C. Tomes, on the subject of a larval form of insect, referable, in all probability, to the genus *Hydroptila*, which is remarkable for the curious and beautiful cocoon it forms of a silky material, covered on the exterior with portions of a Conferva arranged in a remarkable manner. A brief notice of apparently the same object, was given to the Dublin Microscopical Club by Dr. John Barker, as reported in our January number.

Mr. Tomes's paper was, unfortunately, put into our hands too late for insertion in the present number, but will appear with full illustrations by Mr. Tuffen West in our next.

QUARTERLY CHRONICLE OF MICROSCOPICAL SCIENCE.

GERMANY.—**Zeitschrift f. wiss. Zoologie.** Vol. xvii, Part 2—I. "*On the Occluding Apparatus of the Tracheæ in Insects,*" by Dr. H. Landois, and W. Thelen.—The first writer who pointed out the existence of a special apparatus for the closure of the tracheæ was Burmeister,* who described and figured it as found in the larva of *Oxyetes nasicornis.* As the apparatus in question in this insect is placed very close to the stigma, Burmeister concluded that it served for the closure of that part itself. But the authors of the present paper show that, in most instances, the occluding apparatus is quite independent of the stigma, and destined solely to the closure of the trachea. More lately three papers have appeared on this subject :—1. By L. Landois,† who describes the apparatus in question in the Pediculinæ ; 2. by H. Landois,‡ who studied it in the Lepidoptera ; and 3. by W. Thelen,§ whose subject was *Tenebrio molitor.*

The parts composing the closing apparatus are—

1. The bow (Verschlussbügel).
2. The lever or axis (Verschlusshegel, or Kegel).
3. The ligament.
4. The muscle.

The first three parts constitute a sort of frame-work surrounding the commencement of the trachea, and they are articulated together. The "bow," usually of a crescentic form, constitutes the firm basis of the apparatus ; and it surrounds about one half of the tube. The remaining portion is surrounded by a thin membranous ligament, which is drawn towards the "bow" in a variety of ways, and thus effects the closure of the tube. In some cases this approximation is effected by means of a simple chitinous rod connate with

* 'Handbuch der Entomology,' theil i, p. 171.
† L. Landois, 'Zeitsch. f. wiss. Zool,' xv, part 4.
‡ 'Archiv. f. Anatom., &c.,' 1866, p. 43.
§ Ibid., p. 391.

the "ligament." In other cases a rectangularly bent "lever" acts upon the ligament, and thus causes the occlusion of the tube. In the Coleoptera there are either one or two levers of this kind. And the same arrangement is also found in the Hymenoptera.

The contraction of the muscle acting upon the lever or rod, as the case may be, approximates the "ligament" to the "bow," and thus closes the apparatus. On the cessation of the contraction the parts regain their former position by their elasticity.

An apparatus of the above kind is found, according to the authors, in all insects. But in some, as among the Neuroptera—in *Agrion*, *Libellula*, &c.—it is reduced to a minimum. It is very manifest, even in minute species, as in the Pediculinæ and Pulicidæ. In many cases it is so much developed as to constitute a sort of larynx, and as such may serve as a vocal organ.

The solid chitinous parts are always connected in such a way, that in a state of quiescence the tracheal tube remains open, and gives free entrance and exit to the air through the stigma. Muscular action is necessary to close the apparatus. This is effected in all cases by a single muscle, which differs in different species in the greater or less number of its fibrillæ. One end of the muscle is always attached to the extremity of the lever or levers, whilst the other is usually inserted into the occluding apparatus itself, that is to say, in the "bow;" but in some cases in the hypodermis close to the stigma, in which case there is provision of thin vibratile membranes.

The authors then proceed to point out that a closing apparatus of some kind to the tracheæ must be required in all insects, inasmuch as the movement of the air in the tracheæ can only be effected by the movements of the body or muscles, &c., which, were the exit of the air at all times free, would have as great a tendency to expel it through the stigma, or even a greater than to force it onwards into the minute ramifications of the tracheal system.

The remainder of the paper, which occupies nearly thirty pages, and is illustrated by beautiful figures, is taken up with a description of the modifications presented by the occluding apparatus in various insects.

1. Among the Coleoptera in *Cicendula campestris*, *Geotrupes vernalis*, *Meloæ proscarabæus*, *Curculio nebulosa*, *Melolontha vulgaris*, *Hydrophilus piceus*, *Lamia textor*, *Lucanus cervus*.

2. Among the Lepidoptera in *Pieris rahæ*, *Vanessa urticæ*, *Cossus ligniperda*, *Pygæra bucephala*.

3. HYMENOPTERA, *Bombus terrestris, Apis mellifica,* and the *Entomospheces.*

4. DIPTERA, *Musca vomitoria, Pulex canis.*

5. NEUROPTERA, in which, as before remarked, the apparatus is less developed than in any other order of insects, its condition is described in *Panorpa communis.*

6. In the BUGS we find *Cimex lectularia, Pentatoma baccarum.*

7. ORTHOPTERA, *Periplaneta orientalis.*

II. "*On the occurrence in the encysted condition of Distoma squamula,* Rud., *in the Brown Frog,*" by Dr. Ernst Zeller.—In certain districts, and in the author's observation especially in the neighbourhood of Tubingen, the integuments of the frog are found to be studded with numerous little nodules, which do not seem to have been hitherto noticed or explained. When present they may vary in number from thirty or forty to several hundreds, and they are scattered all over the body, but are especially frequent in the hinder extremities, in the membrane between the toes, and on the abdomen. They project manifestly above the surface, and are about the size of a common pin's head, and of a whitish colour, though sometimes brownish or blackish. They are lodged in the substance of the corium, and consist of a firm connective-tissue capsule which contains the colouring matter, and of a minute cyst lodged in this capsule.

The cyst, which is easily enucleated, is spherical and about 0·58mm. in diameter, of a white colour, and semitransparent. It contains a convoluted *Distoma.*

The anatomy of the worm is then described, and it is shown to be distinct from all the encysted Distomata hitherto met with in the frog, viz., *Distomum crystallinum,* Rud., *Distoma diffuso-calciferum,* Gastald, *Distoma acervicalceferum,* Gast., *Distoma tetracystis,* Gast. All of which, besides their differing in anatomical structure, are lodged *beneath* the integument.

The author has satisfied himself that it is identical in the *mature* state with *Distomum squamula* of Rudolphi, which is found in the intestine of the *Iltis.*

III. "*On the Embryonal Development of Asellus Aquaticus,*" by Dr. Anton Dohrn.—This is a very long and elaborate memoir, illustrated with figures showing (1) the development of the embryo in the ovum of *Asellus aquaticus,* and (2) that of the internal organs—liver, dorsal vessel, stomach, and intestine.

IV. "*A Contribution on the subject of the Structure of the Thyroid Gland,*" by Dr. Peremeschko, of Casan.—The struc-

ture of the thyroid gland, he says, still remains in some measure a subject of dispute. In the writings of anatomists the most contradictory views are met with respecting the essential elements of the organ, namely, the vesicles; and especially are the opinions of enquirers divided with regard to the secretion of the gland, viz., the so-termed colloid substance; some regarding this as a normal product, and others as a pathological one. The size of the vesicles, which depend upon the greater or less accumulation within them of the colloid substance, is regarded by many as a diagnostic character of a normal or pathological condition of the organ. These and similar differences of opinion have induced the author to think that it would be useful to submit the structure of the gland to further comparative investigation. With this view he has examined it in man, dog, cat, rabbit, hedgehog, mouse, rat, sheep, ox, calf, pig, jackal, fowl, and raven; in all of which the structure of the gland is the same, consisting, as is known, of vesicles which constitute the essential element, connective tissue, blood, lymphatic vessels, and nerves.

As regards the structure of the vesicles, the author has never been able to perceive any *membrana propria*, as described by Kölliker, and denied by Frey, Hessling, and others; whilst some assert that the *membrana propria* is lined with an epithelium, the existence of which is disputed by others, as Eulenberg and Ecker.

Though unable to find any *membrana propria*, Dr. Peremeschko has satisfied himself of the presence of an epithelial lining, which rests immediately upon the surrounding homogeneous, membranous layer, formed of condensed connective tissue. The epithelial cells are firmly attached to each other, and but loosely to the connective tissue layer, so that in some instances the entire vesicle may, as it were, be enucleated. He finds the vesicles to increase in size in proportion to age, and consequently that what has in some instances been regarded as a pathological enlargement, may have been merely due to the advanced age of the animal.

The paper is a very interesting contribution to our knowledge of the thyroid gland.

V. "*Contributions on the Anatomy and Classification of the Holothuriadæ*," by Emil Senka.—After a short but very comprehensive account of the anatomical structure of the Holothuriadæ, which leaves little to be desired, the greater part of this very valuable paper is occupied with a systematic classification and description of the species contained in the rich collection brought together by Professor Keferstein, in the Zoological Museum of Gottingen; and the still richer stores of

the Museum of Cambridge, U.S., which had been furnished to the author by Professor Agassiz.

The paper is one of the most valuable memoirs on the subject that has ever appeared. The observations respecting the calcareous deposits in the integument, some of which are stated to be formed of that form of carbonate of lime termed arragonite, will be found highly interesting to microscopists.

Max Schultze's Archiv fur Mikr. Anatomie.—Vol. III, 1st and 2nd Parts.—We have to notice the two parts of our valued contemporary issued for the first part of the present year. The papers in the first number are the following:

1. "*Researches on the Physiology of the Phycochromaceæ and Florideæ*," by Dr. Ferdinand Cohn, of Breslau.

2. "*Researches on Microphotography*," by Dr. Berthold Benecke, of Königsberg.

3. "*On the Sculpture of the Siliceous Shell in Grammatophora*," by M. Schiff, of Florence.

4. "*On the Structure of the Liver of Vertebrate Animals*," by Dr. Ewald Hering.

5. "*On the Epithelium of the Maculæ acusticæ of Men*," by Dr. Odenius.

6. "*Note on a Yellow Injection-fluid*," by Prof. Hoyer, of Warsaw.

Dr. Cohn, in his paper, which is one of considerable extent, has made use of the spectrum in examining the colouring matters; and his researches on that account, as also from their relation to the movements of low organisms, and his other observations elsewhere noted, will interest our readers. Dr. Cohn thus gives his results *in extenso* at the conclusion of his essay:

(1) The verdigris colouring matter of the Phycochromaceæ—namely, the Phycochrome of Nägeli—is a compound body, consisting of a green matter known as chlorophyll, which is insoluble in water, but soluble in alcohol and ether, and of a blue matter to be called Cohn's phycocyan, which is soluble in water, and insoluble in alcohol and ether. (This latter must not be confused with the phykokyan of Kützing, which is synonymous with the phycochrome of Nägeli; neither with the phycocyan of Nägeli, which corresponds with the blueish-green modification of phycochrome.)

(2) In the living cells both colouring matters are intimately connected and form a mixed colour, phycochrom. In consequence of the changed osmotic relations which take place on the death of the cells, the phycocyan is dissolved in the water which penetrates by endosmosis, and then appears

by dialysis as a blue fluid, whilst the chlorophyll remains in the cells.

(3) The most characteristic properties of the aqueous solutions of phycocyan are, 1st (spectrum), their lively fluorescence in carmine is destroyed by heat and by very many reagents; 2nd, their separation into water and colouring-matter in the capillary spaces of filtering-paper; 3rd, their dimness and colourlessness on being boiled; furthermore, phycocyan is precipitated from its solution as a blue jelly on the addition of alcohol, acids, and metallic salts, and as a colourless one by potash and ammonia.

(4) The purple-red or violet phycochromaceæ contain phycochrome, which is composed of chlorophyll and a purple, but generally (not apparently different) blue modification of phycocyan, which easily turns into a verdigris-coloured substance.

(5) The red-brown colouring-matter of the Florideæ—namely, the rhodophyll of Cohn—is also a compound body, consisting of Cohn's chlorophyll and phycoerythrin, neither of which are analogous to Kützing's phykoerythrin (which is rhodophyll), or to Nägeli's phycoerythrin (which is a purple modification of phycochrome).

(6) Further, rhodophyll, which is undivided in the living Florideæ-cells, becomes split up into its two component parts after death by the endosmotical passage of water; in which case the green chlorophyll remains in the cells, whilst the red phycoerythrin is taken away by dialysis in a watery solution. This exhibits a lively fluorescence in the yellow part of the spectrum (Rosanoff), or the green part (Rytiphlœa, Cramer), and is acted upon by boiling, alcohol, acids and bases in the same manner as phycocyan. It has not yet been determined exactly how the purple modification of phycocyan and phycoerythrin differ.

(7) The near relationship of phycocyan and phycoerythrin, on the one side, and that of the two bodies which are formed of these and chlorophyll (namely, phycochrome and rhodophyll), on the other, is confirmed by the fact that phycochrome is present in the Florideæ, whilst rhodophyll is present in their nearest allies, namely, *Bangia*, *Chantrausia*, *Batrachospermum*, and *Lemania*, which, although belonging to the Florideæ, include verdigris-coloured species as well as red, and thus point to a nearer relationship between Phycochromaceæ and Florideæ. This is strengthened by a fact in the history of their development, namely, the want of vibrating cilia, and the consequent self-movement of their reproductive cells.

(8) The old ideas concerning the vibratory movement of the antherozoids in the Florideæ arose most likely from confusing them with the zoospores of epiphytic *Chytridia*.

(9) Two principal types are united in the Algæ, which, commencing with their lowest homologous forms, differ more and more in their higher stages of development, and are most easily characterised by the presence or want of swarm-cells, which are moved by flagella or vibratory cilia. The first order commences with the Chroococcaceæ, to which the Bacteria and Oscillariæ, and to which the Vibriones belong, as also Nostocaceæ, Rivulariæ, Scytonemæ; thus finishing with *Lyngbya* and *Lirosiphon; Bangia* belongs to the Florideæ, and, through the Collemaceæ, is connected with Lichens (Ascomycetes). The propagation-cells of all of them are without organs of movement; the colouring-matter, as a rule, is not pure green, but generally composed of chlorophyll and another separable body.

The second order begins with the Protococcaceæ, includes the Chlorosporeæ, Phæosporeæ, Fucaceæ, and finishes by connecting itself with the Mosses through the Characeæ. In this division, in which either the whole or only the asexual, or only the male reproducing-cells are provided with whips (flagellatæ) or cilia (ciliatæ), the colouring-matter is either a pure chlorophyll or else a red or brown modification of that body.

(10) Since among the colouring-matters of those Algæ which are not green in colour, phycochrome and rhodophyll both contain a large amount of chlorophyll in their composition; and since also the brown colouring-matter of the diatoms Phæospores and Fucaceæ, as well as the scarlet oil (hæmatochrome) of chlorospores, seem merely to be modifications of chlorophyll, we may say that chlorophyll is the means of carrying on the process of assimilation in all developing plants.

(11) The movement of the Oscillariæ depends on three facts:—1st. A steady but changeable rotation around the long axis of the plant. 2nd. The power of being able to push itself variably backwards and forwards. 3rd. The power of being able to bend, to stretch, and to twist, or, in one word, its flexibility.

(12) The reason of the rotation has not yet been discovered. The forward motion seems, as in the wheels of a carriage, to come from the revolving movement through pressure on the substance which supports the Oscillaria, because the Oscillaria, as a rule, are never able to move forwards, except when they have some surface for support, such as a

foreign body, their own threads, or the surface of the water, and also because they are generally not able to swim freely through the water.

(13) The property to bend and twist themselves, which, combined with rotation, seems to give them a pendulum-like movement, depends upon the contractility of the cells, which shorten a little on the concavity of the bend, and stretch a little on the opposite side. The contractility is so great in *Beggiatoa mirabilis* that it produces vermicular waves, and gives peristaltic movement to the threads.

(14) Certain Oscillariæ—namely, *Beggiatoa*—give rise in water, perhaps through the decomposition of sulphuric salts, to free sulphuretted hydrogen. Since this class of Algæ alone thrives in hot and strongly salted waters, it appears probable that the first organisms which were present in the sea of high temperature which covered the earth were Oscillariæ, or rather Chroococcaceæ.

The only other article which we can notice from this number is that of Dr. Hering on the Liver.

The substance of this paper was communicated in parts to the Academy of Vienna. The author concludes that the liver in Reptiles, Fishes, and Birds is to be regarded as a reticularly arranged, tubular gland. The liver of mammals differs in this, that there is nothing whatever to be seen of an ultimate tubular structure. All the oft-repeated assertions of the presence of a tubular structure must be regarded as erroneous. Dr. Hering regards Beale's researches, which tend to prove a tubular structure in the liver of the pig, as erroneous, in consequence of a destructive method of preparation. The view lately put forward, according to which the gall-vessels are regarded as a special system of capillaries, which, like blood-capillaries, have a special membrane forming their walls, external to which the liver-cells lie, is also, according to Dr. Hering's observations on eleven different mammals, erroneous. The analogy between the structure of the liver and other secreting glands consists in this, that there, as here, gland-cells encompass the gland-ducts, so that the latter are everywhere separated from the blood-capillaries by interposed gland-cells. The liver is distinguished from other glands by the relatively large layer intervening between blood-vessels and gland-epithelium. The paper occupies twenty-five pages, and enters very fully into details, a coloured plate accompanying it.

Second Part.—The bulk of this number is occupied by a paper on epithelial and gland-cells, which is illustrated with seven large folding plates, and by a continuation of his re-

searches on the retina by the illustrious editor. The papers are as follow:

1. "*Epithelial and Gland-cells*," by Franz Eilhard Schulze.
2. "*On Secreting-cells in the Integument of Limax*," by Max Schultze.
3. "*On Hyalonema*," by Max Schultze.
4. "*On the Rods and Cones of the Retina*," by Max Schultze.
5. "*On a Theory of Colour-perception*," by Dr. W. Zenker.
6. "*On the Peripheral Ending of Motor Nerves*," by Dr. W. Moxon.

The paper by Herr Franz Schulze appears to be a very elaborate and detailed essay on the epithelial cells of Fishes, Amphibia, Reptiles, and Mammalia, and the plates are very beautifully executed. We cannot, however, here give his results, as they are spread widely over the whole paper.

Prof. Schultze's paper on *Limax* is a short description, called forth by the preceding paper, of the gland-cells in the slug, which secrete the enormous quantity of mucous matter noticeable in these molluscs.

Dr. Pietro Marchi, of Florence, who has been making observations on this structure, is investigating its homologue in other snails, and will publish a paper on the subject shortly.

Prof. Schultze's paper on *Hyalonema* is a translation of that which he recently published in English, in the 'Annals and Magazine of Natural History,' and which we have previously noticed.

Dr. Zenker's paper is one dealing with optical and physical laws, as well as with anatomical structure. He discusses the relation of the wave-lengths of light of various colours to the perception of colour, and gives as his chief result that this sense is not so much to be regarded as dependent on the time of vibration of the light, as on the position of the incident rays in relation to the elements of the retina.

The number concludes with a brief abstract of Dr. Moxon's paper, published in the January number of our Journal.

FRANCE.—**Annales des Sciences Naturelles.**—"*The Reproduction of Aphides*." In our Chronicle of October, 1866, we noticed Dr. Balbiani's paper "*On the Reproduction of Aphides*," in which he maintained their hermaphroditism, and described a hitherto unrecognised "testis." During the same period Herr Mecznikow, a most brilliant and trustworthy observer, was studying the reproduction and development of Aphis, and has published his conclusions in the 'Zeitschrift,' which are very similar to those of Huxley, excepting that he regards a green mass developed in the

Aphis as a secondary rather than as a primary vitellus. It is this green mass which has led Dr. Balbiani so far astray; it is this which he has regarded as the testis, and in which he has seen, as he thinks, spermatozoa. M. Claparède, finding that there was so great a difference between the two latest observers on this subject, at once set to work to see which he could best agree with, and made a series of observations on the Aphis of the rose at Naples. He believes that Herr Mecznikow is entirely right, and that Dr. Balbiani has been deceived by the presence of parasitic Mucedineæ in the green secondary vitellus, which he has regarded as spermatozoa. M. Claparède found such Mucedineæ in some, but not all of the Aphides he studied at Naples. It is very remarkable that Dr. Balbiani, who has but just been writing on the parasitic nature of the silkworm disease (wrongly, perhaps, considering the parasites as psorospermic), should not have recognised in his so-called spermatozoa — vegetable parasites — especially as he himself remarks on the similarity existing between the two. One argument against Dr. Balbiani's views, which appears to us a very strong one, is not adduced by M. Claparède. He states himself that this green secondary vitellus, which he calls a testis, is developed to *an equal extent* in both those Aphides, which reproduce without the action of the male, and those which are simply females, and require the assistance of male Aphides; also that it exists equally in both sexes, and that the testis of the normal male Aphis does not arise from it by any process of modification, and that an ordinary testis is a very different thing from this testis. So different a thing, we think, that we do not hesitate to call it, with MM. Mecznikow and Claparède, by another name, and can but feel surprise that a fecundating function (involving the assumption of heautandry) could ever have been ascribed to it.

At the conclusion of M. Claparède's very courteous demolition of Dr. Balbiani's views in the 'Annales,' is a short rejoinder from that author, in which he asks for a suspension of opinion till the full publication of his memoir and drawings.

Robin's Journal de l'Anat. May and June, 1867.—"*On the Structure of the Suprarenal Capsule of Man and of some animals*," by Dr. Grandry, of Liége. This is the first part of a detailed description of these organs—illustrated with two well-drawn plates.

"*Studies on the Psorospermic Disease of Silk-worms*," by M. Balbiani.—M. Balbiani has the credit of having been amongst the first to show that the fatal silk-worm disease

results from the presence of innumerable parasitic corpuscular bodies. In the present memoir he describes them and experiments with them, and figures them very admirably in a plate. Why M. Balbiani calls them "Psorospermic" requires explanation. The psorosperms of fish have been identified (perhaps hastily) with the pseudo-naviculæ of *Gregarinæ*. *Gregarinæ* are *undoubtedly* animals, therefore psorosperms are also of animal nature. But M. Balbiani says the silk-worm corpuscles are both vegetable and psorospermic, and M. Béchamp has shown that they act as vegetable ferments—hence either they are not psorosperms, or psorosperms are vegetable, and not connected with *Gregarinæ* at all. The latter is the view which M. Balbiani has elsewhere taken, and like M. Ch. Robin, whose pupil he is, ranks the Psorosperms amongst vegetable parasites—not connecting them with *Gregarinæ* at all. A much less questionable view of the corpuscles of the silk-worm disease is that they are parasitic Mucediniæ—similar to those mistaken by M. Balbiani (according to M. Claparéde) for sperm cells in the vitellus of Aphides. It is not at all improbable that the identity of psorosperms and pseudo-naviculæ has been accepted on too slight grounds.

ENGLAND.—**The Journal of Anatomy and Physiology.** The second number of this half-yearly magazine has appeared and contains a good set of papers. Those on microscopical matters are

1. Dr. Ransom, "*On the Movements of the Ova of Fishes.*"
2. Dr. Bennett, "*On the origin of Hyaline Corpuscles.*"
3. Dr. Strethill Wright, "*On British Zoophytes and Protozoa.*
4. Professor Krause, of Gottingen, "*On the Termination of the Nerves in the Conjunctiva.*"

The first of these we have already noticed and abstracted when it was read at Nottingham, during the meeting of the British Association. It was not, however, as stated in the journal under notice, read before the *Physiological Section* of the Association, for such a section does not exist and has not existed.

Dr. Hughes Bennett's paper is a communication of not more than twenty lines with two woodcuts. He mentions that in examining some ovarian cysts of a woman who died in his clinical ward, he observed "groups of the well-known hyaline corpuscles of organic fluids" starting out under pressure from the masses of epithelial cells, and hence he concludes that undoubtedly the diaphanous corpuscles are given off under certain circumstances from cells. He curtly

remarks "how far the observation now detailed may serve to explain the production of cell-walls rising from a nucleus, like the glass from the dial of a watch, as originally described by Schwann, further investigation can alone determine."

The species of Zoophytes and Protozoa noticed by Dr. Wright are the following—*Stomobrachium octocostatum* (Forbes). *Acanthobrachia inconspicua,* nov. gen. spec., T. S. W. *Atractylis bitentaculata,* nov. sp. *Atractylis quadritentaculata*, nov. sp. *Coryne ferox,* nov. sp. *Boderia Turneri,* nov. gen. et spec., a Rhizopod. With regard to this last form the author makes some interesting remarks. He describes a method of reproduction in it by a breaking up into pseudo-naviculæ similar to that occurring in Gregarinæ, and he believes that such a method of reproduction is common among Amœbæ. In both Amœbæ and Gregarinæ he is disposed to view the nucleus as a true ovum, and compares the fission into pseudo-naviculæ to the fissure stage in the ova of higher animals. In the Gregarinæ and Rhizopod this is the final process of egg-development—the divided elements separating to form a swarm of *unicellular* individuals, whilst in higher animals they remain together to constitute a multicellular organism. This view of the case of course assumes the "cell" as an archetypal existence, and is rather premature. The exact structure of the pseudo-naviculæ of Gregarinæ and their homologues in Amœbæ must be clearly ascertained, and all question as to the male element in these animals settled, before any such theory can be received. Has it yet been shown that certain pseudo-naviculæ are not males, and others females, in their reproductive function?

Professor Krause, of Gottingen, makes a few short remarks on Dr. Lightbody's very excellent essay which appeared in the first number of the new Journal. He says that the bodies described by Dr. Lightbody as nerve ganglion-cells in the conjunctiva were recognised by him in 1858 as the terminal bodies of nerves. They are club-shaped and similar to Pacinian bodies, and exist in all eyes, and in various mucous membranes, as those of the lips, tongue, generative organs, &c.

Annals and Magazine of Natural History. April.—"*Note on the Excavating Sponges; with descriptions of four new species,*" by Albany Hancock, F.L.S. Mr. Hancock defends his views on *Cliona* published in 1849, against the objections raised by Dr. Bowerbank. The most important matter in the discussion appears to be whether *Chiona* bores at all or only inhabits galleries previously excavated by "lithodomous Annelids," as maintained by Dr. Bowerbank. This boring

Annelid is certainly a very useful *deus ex machinâ,* but since he has never been seen, nor anything like him, the appeal to his powers is rather an unsatisfactory way of accounting for a phenomenon. No Annelid has at present been described which bores a gallery in shells or limestones, with the single exception of a vague reference by some authors to such a habit in a species of *Leucodore.* Mr. Hancock further contends that the dendritic form of the Cliona-galleries is unlike anything done by worms. The connection between the Foraminifera and Spongiadæ through the excavating *Clionæ* is of considerable importance. Mr. Hancock points out the great similarity of the form of the sarcode substance in the one and the other, and alludes to the genus *Carpenteria,* a Foraminifera which exhibits spicules as further illustrating their relationship—*Cliona celata, Gorgonioides, Northumbrica, vastifica, corallinoides, gracilis, Howsei, Alderi, lobata, vermifera, Mazatlanensis, globulifera,* and *Carpenteri* are described and their characteristic spicula figured—the last four being new foreign species.

"*Remarks on the Falces and Maxillæ of Spiders,*" by John Blackwall, F.L.S. "Much careful investigation is yet required," says the eminent arachnologist, "to complete our knowledge of the various minute appendages connected with the external organs of spiders and of the purposes to which they are subservient." Miss Staveley recently described in the Annals a row of minute teeth on the outer margin of the maxillæ of numerous species of spiders which induced Mr. Blackwell to examine the species of *Mygalidæ,* in the expectation of finding a somewhat different arrangement. The inferior surface of the base of these organs were found to be thus armed in *Mygale, Cteniza,* and *Atypus.* Figures of these structures are given. The late Mr. Richard Beck accumulated some valuable microscopic observations on spiders and acari, which might perhaps be published with advantage.

June.—"*Notes on Pelonaia corrugata,*" by W. Carmichael McIntosh, M.D., F.L.S.—This paper contains a description of the anatomy of this interesting tunicate molluscoid, illustrated with a good plate. Dr. McIntosh communicated a short description of the same animal to Section D at Nottingham, when he considered the creature as new.

"*On the Dentition of the Common Mole,*" by C. Spence Bate, F.R.S.—The investigation of the early condition of the teeth of mammalia is most important as bearing on the homologies of those teeth; and in such researches the microscope has necessarily to be largely used. Mr. Bate's observations

on fœtal and young moles lead him to confirm the dental formula given on other grounds by Professor Owen. It is not, however, at all clear that such a view is the right one, for Mr. Bate's observations would serve to prove that the so-called canine of the upper jaw is an incisor.

AMERICA.—**Annals of the Lyceum of Natural History of New York.** 1866.—We have to notice a paper on "*The Young Stages of a few Annelids,*" by Mr. Alexander Agassiz, the first part of which we mentioned in our last Chronicle, by mistake, as appearing originally in the English 'Annals of Natural History,' the fact being that that excellent journal had merely reprinted the paper. Mr. Agassiz remarks, in the first place, upon the importance of knowing how and where to look for the embryonic forms of various marine animals. They must not be sought by the side of their parents, but along the shore in the scum thrown up by the waves, or amongst the gleanings gathered by a fine gauze hand-net in surface-dredging. Young Annelids, Echinoderms, &c., thus obtained may be kept and watched through their development.

The first form described is a *Planaria* (perhaps *Pl. angulata*, Müller). By his observations on this species Mr. Agassiz has given most important service to the systematist. It appears that the young *Planariæ* exhibit a body distinctly articulated, and of a rounded somewhat cylindrical form which they gradually lose by a retrograde sort of development (as in many Crustacea and Arachnida), and become the flat, undivided animals which are so often compared to the naked Gasteropods.

In *Nareda,* a Nemertean genus, a somewhat similar and remarkable development is described, Loven's annelid-larva being identified with this form. These two cases of development of Turbellarians are of peculiar interest in that they differ from those described by Müller, Busch, Gegenbaur, Leuckart, and Pagenstecher—in not being instances of metamorphosis, but of regular, continuous development. Mr. Agassiz remarks that in Echnioderms, as in Turbellarians, we find closely allied genera undergoing a widely different development, and that an additional resemblance between the two groups is thereby furnished.

Spirobis spirillum is the next marine worm, the development of which Mr. Agassiz notes. He finds this species in America, as here, abundantly attached to *Fucus,* and has some important remarks to make upon the development of the tentacles. He observes that the nomadic life of this species is not more than eight or ten hours, and that after fixing itself in a small tube, development of the anterior part of the

body goes on, whilst the posterior part remains comparatively quiescent.

Polydora spirillum is he remarks very easy to obtain for examination and to trace. His observations on this worm are of importance, as clearing up a confusion existing as to its relation to *Leucodore* of Johnston, which M. de Quatrefages has done much to increase. The *Leucodore* of Johnston is the *Polydora* of Bosc; whilst what Claparède mistook for *Leucodore* of Johnston, as also has De Quatrefages, is really a species of *Nerine* of Johnston, not having the characteristic bristles of the fifth segment seen in both *Polydora* of Bosc and *Leucodore* of Johnston. It further is evident from these researches that *Nerine*, *Spio*, and *Polydore* are most closely allied, and ought not to be widely separated from each other in different families, as is done by M. de Quatrefages.

The young stages of *Phyllodoce maculata*, Œrsted, are the last described in this paper. They thrived very readily in confinement, and enabled Mr. Agassiz to confirm and supplement to some extent Max Müller's observations on the same genus.

The paper concludes with some observations on the types of development in annelids. While considering Claparéde's division the best that has been yet proposed, Mr. Agassiz considers that it must share the fate of Busch's, Müller's, and Schultze's classifications, since our knowledge of the young forms of annelids is at present so very limited. The presence of temporary bristles is a good criterion for one division, but the negative character of their absence alone is objectionable.

Two larvæ are figured which the author cannot refer to their adult forms, and which belong to the group *Metachetæ* of Claparède. One is remarkable as being very possibly the young form of a Turbellarian worm, though itself provided with bristles and having a segmented character. The other is remarkable as being *parasitic* on the interior of the carapace of lobsters, and possessing most characteristic serrulate bristles. Mr. O. C. Marsh showed Mr. Agassiz a series of fossil annelids, which, it is of great interest to note, were all provided with bundles of the large, rough setæ found as temporary characters in living embryonic annelids.

MISCELLANEOUS.—*Reagents.*—Cohnheim and Kölliker strongly recommend the use of chloride of gold for demonstrating various points in histology. Tissues which have been soaked for some time in a weak solution of it, and afterwards exposed to light, are found to exhibit certain parts, *e.g.*, nerve-fibres, connective tissue, corpuscles, and cells in general, stained of a bluish, violet, or reddish colour, while other

parts, *e.g.*, intercellular substance, &c., are untouched. The fresh tissue should be covered with a little of a solution, from one to two per cent. of chloride of gold in distilled water, and allowed to stand until it assumes a straw-yellow colour. It should then be washed and placed in very dilute acetic acid (one to two per cent.). The colour will in the course of some hours gradually develope itself. As a general rule what silver salts stain gold does not, and *vice versâ*. Hyper-osmic acid is difficult to obtain, and dangerous, though it appears to be of great use as a reagent. Vanadic acid has been proposed as a substitute.

"*Structure of the Iris.*"—A. Gruenhagen reviews the anatomical evidence advanced as to the existence of a *dilatator pupillæ* muscle, and concludes by denying its existence in man and animals. He appears completely to have overlooked the observations of Joseph Lister published in this Journal in 1853, in which such muscular fibres were described (Henle's 'Zeitschrift,' vol. xxvi).

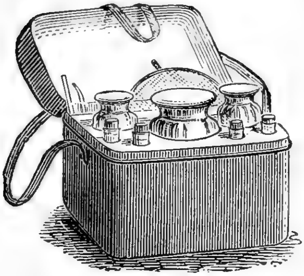
NOTES AND CORRESPONDENCE.

Pleurosigma angulatum.—It is a difficult question to decide, and one which has not yet been determined with complete certainty, as to whether the small spaces or *areolæ* which the striæ of *Pleurosigma angulatum* present are concave and their contour in relief, or, on the other hand, whether the edges form furrows, and their spaces projections. I know that distinguished observers have maintained the two propositions, but, as far as I am concerned, I believe that there exist neither depressions nor elevations on the valves of *P. angulatum;* it is uniformly an optical illusion, produced by the shadow which the *striæ* cast when viewed in a certain way, and which, in my opinion, are not straight lines, but lines slightly broken. The appearance of a hollow or of a relief is particularly due to this circumstance, that the striæ are discontinuous; and what tends to confirm the opinion which I offer, that on the valves of this diatom neither hollows nor projections really occur, is, that according as the focus is changed, the *areolæ* appear at one time dark with clear outlines, at another time clear with dark outlines. This is exactly the effect which is produced if a micrometer is examined and the focus of the lens varied.—MOUCHET, Rochefort-sur-mer.

Collins' Mounting and Collecting-cases.—Mr. Collins, of Great Tichfield Street, has introduced a very complete mounting-case, which must prove useful to microscopists, especially so to those who devote a great deal of attention to the preparation of specimens. It contains a Shadbolt's turn-table, brass table, spirit-lamp, pipettes, spring clips, wooden clips, tweezers, tin cells, balsam, marine glue, asphalte, turps, gold size, thin glass covers, glass slips, and five extra bottles. Another box, more particularly adapted for anatomical purposes, includes a neat injecting apparatus.

Mounting-cases are too often of an expensive character. We therefore call particular attention to Mr. Collins', as it is compact in all its arrangements, and sold at a moderate price. It is by such aids as these that the working microscopist is enabled to pursue his investigations with saving of time and increased satisfaction to himself.

Mr. Collins has also brought out a cheap and portable collecting-case, consisting of a neat japanned case, with sling-strap for the shoulder, and containing three good-sized bottles, four test-tubes, net, and dipping-tubes. A dipping-bottle, made to screw on to the same stick as the net, is also made part of the kit. Another kind is made to fit into a morocco satchel, which allows of space for botanical specimens. This is a very desirable addition to the adjuvanta of the microscopist.

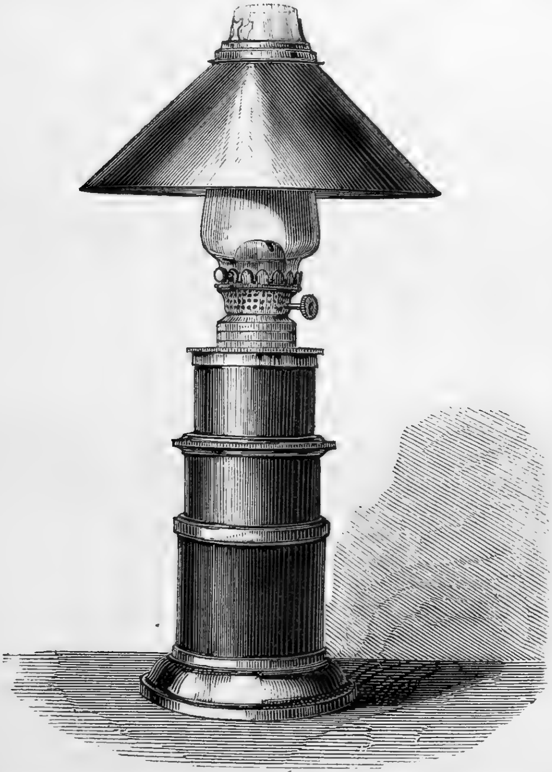


COLLINS' COLLECTING CASE.

On Cleaning Diatoms.—There is often considerable difficulty in cleaning the diatoms contained in guano sufficiently to render it possible to mount the frustules without the troublesome process of selection. The methods of Bailey and of Edwards are partially successful, but they injure the frustules a good deal, and leave amorphous matter in the slides. The following plan has been found very successful in several instances, and is worthy of further trial:—Take a beaker of six or eight ounces capacity, put into it not more than two teaspoonfuls of guano, and fill it up within an inch of the top with a saturated solution of carbonate of soda. Boil it for half an hour, wash the sediment well, pour off the last water very close, and pour in two ounces of hydrochloric acid. Boil for an hour, wash well, pour off the last water very close, and treat the sediment with an ounce of strong sulphuric acid, let the acid act for about ten minutes, and then add cautiously some bicarbonate of soda, either in solution or suspension in warm water, and shake well during the effervescence, taking care that the fluid does not overflow the edge of the beaker. Wash well, pour in with great caution two ounces of nitric acid, and when the effervescence has subsided add one or two pinches of chlorate of potash, and boil for an hour, or until the sediment has become white. If this does not take place in an hour, it might be well to commence the process anew; but so far as the method has been tried, it has never failed. Then wash, and use the ordinary methods for separating the diatoms according to their specific gravities; that of Okeden, as described in Pritchard, is the simplest and best. This process may seem to occupy a great deal of time,

and to be very troublesome; but such is not the case, for if the beaker be placed in a metal bath containing a strong solution of chloride of lime, or of common salt, and then placed over the lamp or fire, it will not require continuous watching, and the vessel need only be examined once or twice.—T. G. STOKES, Aughnacloy.

A Telescope Lamp.—Messrs. Murray & Heath exhibited at the last meeting of the Royal Microscopical Society a telescope lamp. The lamp consists of three tubes sliding in one another, the oil or paraffin vessel being contained in the inner tube. Spiral guides being cut in each of the tubes, the height



of the lamp is regulated to the greatest nicety by simply turning one tube in the other, the guides preventing all chance of slipping. The advantages are compactness, and the absence of the stand and bar usually used for raising and lowering the lamp, which enables the lamp to be used on all sides, and allows of its being brought much closer to the microscope when desired.

PROCEEDINGS OF SOCIETIES.

Royal Microscopical Society.

The annual soirée of the Society was held on the 26th of April, at King's College, when the attendance was unusually large, and comprehended many distinguished visitors, who were received by the President, James Glaisher, Esq., F.R.S.

About three hundred microscopes were exhibited; and Mr. Baines lent an interesting series of views of scenes visited by him in his Australian and African explorations, which were shown by Mr. Wylley, with a gas microscope. One representing that remarkable plant, the *Welwitzia mirabilis*, with its long, green, ribbon-like leaves and red flowers, attracted much attention.

Mr. F. Buckland exhibited a series of objects relating to fish and fish hatching.

Among the microscopic objects were many of unusual interest. Dr. Carpenter brought a beautiful set of slides and drawings illustrating the development of the Comatula.

May 8th, 1867.

The President (James Glaisher, Esq., F.R.S.), in putting the minutes of the last ordinary meeting, alluded in gratulatory terms to the recent *soirée* of the Society, one of the most noticeable and attractive features of which was the large increase in the number of interesting objects exhibited by the Fellows.

The Rev. J. B. Reade read a paper by J. B. Sheppard, M.R.C.S.E., "On an Example of the Production of a Colour possessing remarkable qualities by the Action of Monads (or some other Microscopic Organisms) upon Organised Substances." (See 'Trans.,' p. 64.)

On the conclusion of this paper,

Mr. Browning described, by the aid of a coloured diagram, the appearance of the fluid in the spectrum. (See 'Trans.,' p. 71.)

Mr. Slack remarked that he had never met with anything exactly like the fluid described by Mr. Reade; but some three or four years since he had noticed a pond at Hampstead, the water in which presented a clotted appearance very much like blood. These clots were composed of millions of small bodies, identical with the common *Stentor niger*. When examined by direct light they were of a blood-red, but by transmitted light they were purple; probably the fluid they contained resembled that described by Mr. Reade.

Upon the motion of the President the thanks of the Society were unanimously voted to the Rev. J. B. Reade, Mr. Sheppard, and Mr. Browning, for the preceding communications.

Mr. LOBB read a paper "On Two New Lamps for the Microscope." (See 'Trans.,' p. 72.)

The PRESIDENT said that anything practical and simple was always a great assistance to microscopists, and it gave him great pleasure to have an opportunity of recommending appliances which combined these requisites. He felt sure that the meeting would agree with him in thanking Mr. Lobb for bringing these lamps to their notice.

Dr. LIONEL BEALE read a paper "On Nutrition considered from a Microscopic point of view." (See 'Trans.,' p. 75.)

At its conclusion the President remarked that it generally happened that a thoughtful paper, such as this, required attention and study on the part of the members to enable them to discuss it properly, and he had often felt regret at having to call upon the members to discuss papers of this kind at the moment they were placed before them. He often wished that they could print and circulate the papers beforehand, so that they could be "taken as read" at the meeting, and more time left for discussion. He much regretted that they were not likely to have an opportunity of discussing this most interesting paper at present, but he hoped that the members would think it over very attentively, and on a future occasion perhaps other papers would re-introduce the subject. He would only now ask the meeting to give its warmest thanks to Dr. Beale.

Dr. LIONEL BEALE read a paper "On the Germinal Vesicle of the Ovarian Ova of the Stickleback." (See 'Trans.,' p. 85.)

The PRESIDENT reiterated the thanks of the members to Dr. Beale, and expressed his regret that there was not time for discussion.

The following gentlemen were declared to have been unanimously elected Fellows of the Society:—

George Feddes Forbes, Esq., Surgeon Major, Bombay Army; John Lampray, Esq., F.R.G.S., 16, Camden Square; Thos. Charters White, Esq., 32, Belgrave Road; and the Rev. Benj. Whitelock, Groombridge, Sussex.

Mr. COLLINS, of Great Tichfield Street, exhibited a complete mounting-case, and a cheap and portable collecting-case.

QUEKETT MICROSCOPICAL CLUB.

March 22nd, 1867.

ERNEST HART, Esq., President, in the Chair.

Mr. C. A. Watkins read a paper on "Yeast and other Ferments," in the course of which he called attention to the similarity of the chemical operations of all the ferments, whether they be living organisms, as yeast, or substances derived from organic

sources, as albumen, casein, diastase, &c., and urged the necessity of considering those operations together, rather than separating them into those which are the results of organic growth and those which appear to be simply chemical actions.

The President announced the arrangements which had been made for the "Exchange of slides," and also for "Field Excursions during the season 1867."

Various questions which had been deposited in the question box were then read and discussed.

Ten members were elected.

April 26th, 1867.

Ernest Hart, Esq., President, in the Chair.

Dr. Halifax gave a lengthened and interesting description of his method for obtaining sections of insects, soft vegetable tissues, &c. (as described in vol. vi, 'Q.J.M.S.,' page 170), and exhibited his contrivances for making cells in cement, stoneware, and other materials, most suitable for mounting sections of any kind or shape.

Mr. Higgins read a paper on "Otolites or Ear Bones of Fishes," and in drawing attention to the different medium in which air-breathing animals live from that inhabited by those living in water, he submitted that the adaptation of their organisation to the conditions of their existence is nowhere more clearly marked than in their organs of hearing. In the mammalia the complexity of structure in these organs is much greater than in lower orders, and probably enables them to distinguish in a greater degree the modulations of sound. In air-breathing animals the auditory organs may be said to consist mainly of the ossicula auditus and the cochlea, with an external ear, the use of the latter being to receive and collect the vibrations of sound. In fish an auditory organ of this description would be a very great inconvenience, because water conveys sound so much more readily than air, that the effect of a small sound would produce the sensation of stunning. True fish are therefore deprived of the external ear, except in some members of the Ray family and the sharks, where there is a small process which occupies the position of an ear. In almost all other fish the whole of the auditory organs are contained in the otochrones, which are two holes, one on either side of the head. The internal surfaces of the bones of the head of fish are covered with cartilage, and the semicircular canals, though not large, are not more than half the size of the holes through which they pass, and they are delicately suspended in the middle of them by means of a number of fine threads, the object of this probably being to lessen the shocks which loud sounds might otherwise produce. There are very distinct differences observed in different families of fish. (Instances were given of various modifications in form,

and diagrams, illustrative of the anterior, external, and posterior portions, were exhibited.) The sacculus consists of one large sac, and the superior otolite occupies this position, although in two specimens of the wolf fish he had found that it occupied different positions, and from this circumstance he judged that it might have the power of moving about from side to side. Amongst the Cyprinidæ (or carp family) the otolites occupy a different position; here they are all placed in contact inferiorly, forming a chain of bones. From the lower sac two tubes pass through the base of the skull, and open through the anterior portion of the saccula. These saccula are the only true representatives of the ossicula auditus in the mammalia, according to the opinion of most writers upon the subject, but his own belief was that no fish have any true representatives of it, but that this is only an excessive development of the otochrones. The otolites themselves are found to consist of carbonate and sulphate of lime, with a very small quantity of animal matter, but whether to call it a kind of condensed sarcode, or to consider it the same composition as the Foraminifera, or as that of the oyster-shell, has not been satisfactorily determined. By comparison and examination of these objects he had in many instances been able to identify species, and in many other instances he could identify genera, and he thought this was more than could be said of the fins or any other parts of a fish. He might mention that out of about 4000 specimens which he had examined only one instance had been found in which the species could not be identified, and this one was a common form which had, from some cause, become abnormal in shape and cartilaginous in structure. Specimens are occasionally found in which they are wanting on one side of the fish. He had not examined the true structure of the granules, but in their original forms they present the appearance or rhombic crystals. In the tertiary formations we meet with a very large quantity of specimens in a fossil state, and in the Crag formation all the examples found are identified with species now found on the shores of Great Britain in the present day; they all belong to the cod family. Those discovered in the formations of the Isle of Wight are found to be identical with species now found in the Carribean Sea, showing that when the strata were deposited there must have been a tropical fauna existing here. (A large and valuable collection of specimens of the auditory organs of various families of fish was exhibited.)

Eight members were elected.

May 24th, 1867.

ERNEST HART, Esq., President, in the Chair.

Mr. M. C. Cooke read a short paper on "Nachet's Principle of Binocular Construction," which he illustrated with diagrams.

The President read a paper on "The Structure of the Ciliary Muscle and its Influence in Accommodation of the Eye," in the

course of which he said—'I would not have brought forward a subject so dry and technical, were it not for the fact that the structure of the iris and the ciliary muscle is not alone interesting to the histologist, but it is one of those instances in which the microscope may be brought to bear upon physiological studies; and it seems to me that if we can in any way give the work thus a more practical turn, so as to bring it out of the range of mere amusement, it will be a very useful thing. I wish to direct attention more particularly to the action of these muscles in accommodating the eyes for objects near and far. It is, perhaps, unnecessary to say that what is meant by the accommodative action of the eye is its power of adaptation to the various distances of objects. It is difficult to see objects near and far at the same time distinctly; it is a matter of very familiar experiment, and it is quite evident that some change does take place in the eye itself, either in the shape of the eye or in some other way, but how that change is effected is and has been a matter of considerable doubt, and explanations of it have been offered both by anatomists and by physicists. Helmholtz says that the change consists in an alteration in the shape of the lens, that it is pressed upon laterally at its peripheral edges, and that it bulges in consequence and is rendered thus more convex, and that in this way it accommodates itself to the various distances of objects. It is precisely upon that point that I want my paper to bear.

"The ciliary muscle is attached at the junction of the cornea with the sclerotic coat, and is a membrane spreading out in a fan-like form, and passing into the choroid and the ciliary processes. If you look at this diagram of horizontal section of the eye, you will see that there is no very obvious way in which this muscle can act in the manner described, for since it never gets into any contact with the lens it is difficult to see how the contraction of this muscle can make the lens more convex by pressure. The difficulty, then, was to make the anatomical structure of the ciliary muscle (which requires a $\frac{1}{4}$ inch power for its examination) coincide with the physical theory of Helmholtz. The lens is clear and structureless, and if such a change takes place in its form, it must be by the external action of some muscles such as these. Then came Müller, who made a number of observations which showed sphinctral or circular muscular fibres which he considers can have that action. In the sections and drawings he shows the cut ends of fibres, and these, it is asserted, are true sphinctral fibres encircling the lens as a compressor. I have myself examined a considerable number of sections under $\frac{1}{4}$, $\frac{1}{8}$, and $\frac{1}{12}$ objectives, but in no case have I been able to detect the existence of anything which I can consider a sphinctral muscle. Mr. Lockhart Clarke also has made a careful examination of them, but could detect nothing of the sort. Cut ends were visible, but they were not the ends of a series of fibres having a circular course, if they be the ends of *muscular* fibres at all. In man the ciliary muscle is formed of soft, unstriped fibres, so that

it cannot be easily distinguished from muscles of ordinary elastic tissue, but it is open for any one to say that they are the ends of real muscular fibres. It is, therefore, necessary to resort to other specimens; and in birds we find that the muscle is striated and beautifully striped, so that in them there is no mistake, and it cannot be taken for anything but what it is. I have made a number of sections, of which I present a series here to-night, to verify these my statements. By tinting with carmine, it is perfectly easy to see where there is muscular fibre, and amongst the whole of the specimens examined there is not one which contains a single circular or sphinctral muscular fibre. It is open to say that the muscle of a fowl is not arranged in a way similar to that of man, but if we find that in birds there absolutely is nothing of the kind, and in man there is only that which can be even guessed at, it therefore appears as if the thing had but an imaginary existence. If, however, in this way we throw doubt upon that accepted theory of the effect upon the lens, of the circular fibres of the ciliary muscle, if this be a true objection—and it is one merely destructive of fact without giving us in its place a constructive theory—the matter is not left where we should wish to leave it. In the bird nothing can be more clear than that the fibres of this muscle pass into the cornea from the sclerotica, and that they terminate in the cornea almost *en masse*. I have here some specimens in which the whole ring of muscular fibres is shown to terminate in the cornea, and I have also some drawings made by Mr. Ruffle from the preparation, showing what he saw; and although he shows only one part of the truth, he shows just that very portion that I am pointing out now. As he saw it, the whole of this anterior portion is inserted into a ring surrounding the cornea. Well, then, you see if you have in the bird a great mass of muscular fibre, passing from the sclerotic into the cornea, you get at once a hint that the old physical theory (that which was replaced by this theory under consideration), that the curvature of the cornea was changed, gets some support. Helmholtz says that he can detect no change in the shape of the cornea, and in the face of this I am not going to set up any theory. Some time ago I took out the eye of an ostrich, for disease—one of the ostriches at the Zoological Gardens—and I gave it to Dr. Lawson, who published a paper on it in the 'Popular Science Review,' showing the corneal insertion of the muscle. But leaving the optical part of the subject, I wish to say that by continuing inquiries as to the structure of the iris in birds, seals, and creatures which see both above and under water, and in whose case great power of adaptation is possessed in order to enable them to see in different media, there is ground for believing that great alteration may be made in the present theory of accommodation simply by microscopic research. In the whole of the bird tribe this circular ciliary muscle is entirely absent, and in the case of oxen, pigs, and in man, there is, I hold, no proof whatever of the existence of a sphincter muscle either. Whilst carry-

ing out these investigations I came upon rather an interesting structure connected with the iris, and which has not before been described; I call it the "posterior pillars of the iris." Its attachments, where it runs into the anterior choroidal membrane, are by true tendinous fibres, and at their moment of origin they have a beautiful tree-like form. The preparations under the microscope show this. I have also here a preparation of the nerves of the iris, a fine plexus of nerves terminating in a true circle, and covering the whole surface of the iris like a fine network, which I have never before, I believe, seen in this country. Probably with a paper so technical many of the members present may not have felt sufficiently interested, but I shall be happy to show any one these preparations who takes an interest in them, or to afford them further information on the subject.

Ten members were elected.

Dublin Microscopical Club.

17th January, 1867.

Dr. E. Perceval Wright (who was unable to attend) sent for exhibition, under Dr. Barker's microscope, a specimen of *Staurastrum tumidum* from "Callery Bog," which (just at the boundary of the very dense and conspicuous gelatinous investment, in itself characteristic of this species) was surrounded by a number of minute round green cells, each of these seemingly supported on a very delicate linear stipes, reaching to the body of the Staurastrum. The radiant lines so often apparent in the thick gelatine investing the Staurastrum rendered it sometimes difficult to distinguish between them and the very delicate stipes of these bodies. They do not appear to be parasitic, as the Staurastrum was quite healthy and intact. The rounded cells eventually became detached and moved away as zoospores.

Mr. Archer had found, from the same locality, and on the same occasion, several instances of the same species (*Staurastrum tumidum*), as well as some other Desmids, being the bearers of this curious little plant. Sometimes, as in Dr. Wright's specimen above described, they cover the whole outer surface; at other times they were much fewer, and even only two or three upon a single desmidian: perhaps many of the green cells may have already disappeared from the latter as zoospores. There could be little doubt but that the present little alga, be its true affinity and nature what it may, was the same as that "pin-like parasitic growth" alluded to and figured by Dr. Wallich ('Ann. Nat. Hist.', 1860, Plate VIII, fig. 5) as attached to a joint of *Streptonema trilobatum*. As to its affinities—temporarily admitting its right to a location like other forms which have not yet revealed any mode of reproduction except that by zoospores—its structure seems to point to Dictyosphærium (Näg.). *Dictyosphærium Ehrenbergianum* (Näg.) is composed of elliptic cells

supported on an extremely delicate stipes, which becomes itself dichotomously divided with every self-division of the elliptic cells, the aggregate family forming a group of a more or less rounded figure, and the dichotomously branching stipes radiating from a common centre or starting-point, where once stood the primary cell of the family. The cells are themselves ultimately set free as zoospores. Two other species of Dictyosphærium are distinguished from the first found form, *D. Ehrenbergianum*, by the very different form of the cells and much greater size. Now the plant at present exhibited agrees with *D. Ehrenbergianum* (Näg.) by the cells being supported on a slender linear stipes and by being set free as zoospores. It differs therefore (generically?) by the stipes not being forked or branched, and by these being attached (not to each other starting from a common centre), but independently to various other algæ (Desmidieæ). The cells here are round, not elliptic as in the plant mentioned. It is perhaps just possible that the figure of "Phycastrum pilosum (Näg.)" as given by Nägeli might represent a Staurastrum having attached thereto some such similar but smaller growth, although by Nägeli regarded as spines appertaining to the Desmid itself.

Dr. John Barker exhibited a minute unicellular production which he would provisionally refer to the genus Chytrydium. This consisted of a very slender, fusiform, colourless, usually arcuately curved cell, acute at the basal, somewhat truncate at the apical extremity, immersed in the external gelatinous investment (from which this organism may possibly for a time have derived its nutriment), and sometimes seemingly in contact with the filament itself, of *Didymoprium Grevillii*. Numbers of these fringed several of the filaments of that desmidian, round which they curved, and though, doubtless, to be regarded as parasitic, these seemed to remain attached for days or weeks without causing any very appreciable injury to the joints, although finally some had become effete and brown. No rootlike attachment, as in some species of Chytridium could be noticed. Some of these showed their contents separated into a number of minute rounded portions arranged within these very slender cells in a single file; but no discharge of zoospores had been seen.

Mr. Archer showed *Chytridium endogenum* (A. Braun) inhabiting the interior of an effete *Closterium lunula*, partly with contents, partly evacuated by the zoospores, and well showing the characteristic neck of this species partially and fully protruded through the outer wall of the *host*-Closterium.

Dr. Moore showed some Scytonemeæ lately gathered in the West at Chilomore Lake; two forms very distinct of Sirosiphon (one *S. ocellatum*) and of Scytonema. Without authentic specimens it would be most difficult to arrive at a satisfactory determination of the species as named by authors, although the distinctness of the forms themselves now shown, and as they usually present themselves, is very evident.

Dr. M. H. Collis exhibited specimens of cheloid tumour stained

with carmine solution after the manner of Professor Beale. He also showed some sections of epithelioma of the tongue with polarised light. In these sections it was observed that the healthy muscular fibres polarised the light, while the diseased parts did not do so. Dr. Collis accounted for this by the greater density of the sound parts. It is well known that cancerous and similar morbid cells of large size are of great tenacity. In fact, it would appear as if the proper substance which should have formed a healthy cell went to form this much larger and diseased cell; consequently the latter is found to be more perishable, more easily acted on by chemical re-agents, and less dense. Dr. Collis believed that in doubtful cases this additional means of diagnosis would be of some value.

Rev. E. O'Meara drew attention to and pointed out the characteristic marks of several new Diatomaceæ discovered by him in the late gathering made by Dr. E. Perceval Wright off Arran Islands. These were named by him *Coscinodiscus fasciolatus*, *Stauroneis rhombica*, and *Cocconeis concifera*, descriptions of which will appear in this Journal.

21st February, 1867.

Dr. John Barker drew attention to a minute rhizopodous form which seems to present a new generic type. This was extremely minute, non-testaceous, broadly-subelliptic in outline, giving origin, at the extremities, to a somewhat crowded, slightly branched tuft of slender filiform pseudopodia. These tufts did not emanate from directly opposite points, but somewhat obliquely as regards each other. A comparatively large, not exactly central, amber-coloured oil-like globule was immersed in the substance of the body, the rest of which was colourless, exhibiting little of structure or other differentiations. The pseudopodia were very slow and sluggish in their movement or change. Thus it might be seen that this organism might be defined, so to speak, as representing a non-testaceous Amphitrema (Arch.), bearing a relationship to that form somewhat comparable to that of Plagiophrys to Pseudodifflugia (Schlamb.).

Dr. Moore showed a Cthonoblastus (Kütz.) = Microcoleus (Harv.), taken in the botanic garden, and adverted to the relationship of that genus to Oscillatoria.

Mr. Woodworth showed a number of photographs of polariscopic objects (crytals) taken most successfully, and showing all the characters of striation, &c., evinced by these objects in a very delicate manner.

Dr. Frazer mentioned another instance which had occurred to him of a singular mistake on the part of the uninitiated in taking portions of the pulp of an orange for intestinal worms. A gentleman had forwarded to him what turned out to be some shreds of the membrane of the cells of the pulp of an orange, and who had

persuaded himself that he had actually seen the reputed worms moving about.

Dr. Alexander Dickson exhibited some very interesting preparations, showing in various stages of development the pair of curious root-like temporary appendages, emanating from the base of the suspensor in Tropœolum.

21st March, 1867.

Dr. E. Perceval Wright exhibited the spicules of Hyalonema and Euplectella, and pointed out their resemblances and differences, comparing them also with examples of known sponges.

Dr. Collis showed a section of a bony tumour as an opaque object; the concentrically arranged layers and wide cavities, very like Haversian canals, of this porous substance, could be well seen, as well as certain grooves in which blood-vessels had lain. It differed from true bone in the irregular arrangement of these canals and in their varying size, also in the lacunæ being almost absent, and the canaliculi very small. The tumour from which these sections were made was of thirty years' growth.

Mr. Crowe showed fine specimens of *Œdogonium tumidulum*, well showing the antheridia and nascent oogonia.

Rev. E. O'Meara exhibited specimens of a Diatom, the type of a new genus, which he named Ptychodiscus, and the species *Ptychodiscus lineatus*, from the Arran gathering; a description and figure of which is to appear in this Journal.

Dr. John Barker exhibited a parasitic growth on *Didymoprium Grevillii*, which appeared somewhat akin to that he drew attention to at the January meeting; but in this instance the filaments were not curved but erect and straight, and gave off slender and numerous branches at the apex. The stem, so to call it, was rather thinner at the base than at the summit, and seemed to hold imbedded in it a single series of colourless globular bodies. When two or several of these growths occurred near each other the branches of one often leaned towards those of a neighbour, and they became mutually entangled.

Mr. Archer showed specimens and drawings of the various stages of the development and of the perfect zygospore of *Spirotænia condensata* (Bréb.), especially interesting as being the first recorded instance of the fructification in this pretty species (the position of the genus remaining hence doubtful) as well as presenting the characteristic of being externally surrounded not by spines of any fashion, but by a honeycomb-like structure. The zygospores are moreover double or *twin*, each pair of parent conjugating cells, by a preparatory separation of the contents into two portions, giving origin to a pair of zygospores, in which respect there is a parallelism in *Closterium Ehrenbergii* and *Closterium lineatum*. Inasmuch as a detailed account of the conjugation and of the zygospores, with figures, appears in the present number of this Journal, it becomes unnecessary to enlarge upon them here.

Mr. Archer showed in the same gathering, but not nearly so numerous, conjugated examples of *Penium closterioides*. The zygospore of this fine species has hitherto been unknown. It is, however, what might be *à priori* predicated for it, a broadly elliptic, thick-walled, smooth zygospore, and placed between the shortly deciduous empty parent cells.

Mr. Stoney submitted to the Club reasons which appeared to him, in the present state of science, to require the general adoption by scientific men of the subdivisions of the metre in estimating micrometrical magnitudes. He observed, too, that all confusion and inconvenience arising from the use of *fractions* may be avoided by a very simple extension of the nomenclature of the metrical system, which he thought himself justified in recommending to the Club, from the assistance he had himself received from it.

The following table contains what little is needed to enable microscopists to determine the values of their present scales in parts of a metre.

The Metre is defined by the Act which has legalised the use of metrical weights and measures in the British dominions, as equal to 39·37079 inches, which is almost exactly 16 millimetres short of 40 inches. Hence

The Decimetre—the Hand-breadth or Palm—which is $\frac{1}{10}$th of a metre = 1·6 millimetres less than 4 inches.

The Centimetre, which is $\frac{1}{100}$th or $\frac{1}{10^2}$ of a metre = 1·6 Vth-metres less than $\frac{4}{10}$ths of an inch.

The Millimetre, which is $\frac{1}{1000}$th or $\frac{1}{10^3}$ of a metre = $\frac{1}{25}$th of an inch, with sufficient exactness for ordinary microscopical purposes. (An inch = 25·4 millimetres almost exactly.)

A centimetre divided into millimetres.

Four tenths of an inch.

The Fourth-metre, which is $\frac{1}{10000}$th or $\frac{1}{10^4}$ of a metre = $\frac{1}{250}$th of an inch.

The Fifth-metre, which is $\frac{1}{100000}$th or $\frac{1}{10^5}$ of a metre = $\frac{1}{2500}$th of an inch.

The Sixth-metre, which is $\frac{1}{1000000}$th or $\frac{1}{10^6}$ of a metre = $\frac{1}{25000}$th of an inch.

The Seventh-metre, which comes next, is a measure almost too small for microscopical purposes, since the wave-lengths of light range between 4 and 8 VIIth metres.

Every microscopist should habituate himself to *estimate* the sizes of objects when viewed under the several powers with which he is accustomed to work. For this purpose, it is well to determine the diameter of each field of view, and also to fix on the memory the appearance with each lens of objects of the standard

sizes—a Fourth-metre, a Fifth-metre, and a Sixth-metre across. After this has been once for all done, it is wonderful with what precision eye-estimates of size can, after a little practice, be made: the eye quickly coming to be able with ease to hit off within a tenth of any of the standard measures.

At present microscopists comparatively seldom resort to measures; and, when stated to one another, they are apt to require separate attention to appreciate them. If a better system were introduced, it is probable that, estimations being made and understood without effort, they would soon come to be made habitually, and so contribute very much to scientific accuracy.

The following measures will serve as examples:—

The colourless discs in blood are about 8 VIth-metres across in vertebrates, and about 10 in reptiles.

The red discs are about 2 VIth-metres across in the musk-deer, the animal in which the smallest have been found; 8 VIth-metres in man; 6 by 12 VIth-metres in the crow; 7 by 12 VIth-metres in the hen; 14 by 23 VIth-metres in frogs; and 77 VIth-metres, which is nearly 8 Vth-metres in the proteus, the reptile in which the largest have been observed.

A Vth-metre, then, is a little more than the diameter of a disc of human blood. It is of so convenient an intermediate size in reference to microscopical magnitudes that it will be found a good plan to make a practice of registering all determinations in this measure, so as to have nothing but numbers to write down. Thus, for example:—

	Vth-metres.	
Diameter of *Volvox globator*......	=80·	(which may be read 8 IVth-metres.)
Red discs of human blood	= 0·8	(to be read "8 VIth-metres.")
Ditto of frogs	1·4 by 2·3	(to be read "14 VIth-metres by 23.")
Cilia have been observed ranging in length from	from 5 to 0·2	(from 5 Vth-metres to 2 VIth-metres —a range analagous to one from 5 feet to about two inches.)
The closest interval between the lines on mother-of-pearl is about	0·3	(3 VIth-metres.)
The length of lacuna in human bone varies from.................	1 to 1·8	(from 10 to 18 VIth-metres.)
Breadth of ditto from...........	0·3 to 0·6	(from 3 to 6 VIth-metres.)

The interval (according to Prof. W. Smith) between the markings on—

Pleurosigma formosum......(diag.)	= 0·07	(7 VIIth-metres.)
,, *strigile* ... ...(trans.)	= 0·07—	(to be read "rather less than 7 VIIth-metres.)
,, *Balticum*......(trans.)	= 0·06+	(rather more than 6 VIIth-metres.)
,, *attenuatum*...(trans.)	= 0·06+	(Ditto.)
,, *hippocampus* (trans.)	= 0·06+	(Ditto.)
,, *strigosum* ......(diag.)	= 0·06—	(rather less than 6 VIIth-metres.)
,, *quadratum* (*Nav. angulata*, Soll.) (diag,)	= 0·06—	(Ditto.)
,, *elongatum* (*Nav. liniata*, Soll.) ...(diag.)	= 0·05+	(rather more than 5 VIIth-metres.)
,, *lacustra* ......(trans.)	= 0·05+	(Ditto.)

Pleurosigma angulatum (*Nav. strigosa*, Soll.) ...(diag.) = 0·05—(less than 5 VIIth-metres.)
,, *æsteiarii* ......(diag.) = 0·05—(Ditto.)
,, *fasciola* (*Cerat. fasciola*, Soll....(trans.) = 0·04 (4 VIIth-metres.)
Navicula rhomboides ......(trans.) = 0·03 (3 VIIth-metres.)
Nitschia sigmoidea (*Nav. sigmoidea*, Soll.) ....(trans.) = 0·03 (Ditto.)

It is of interest to compare these measures of test objects with the lengths of waves of light.

The wave-lengths of violet, indigo, and blue rays, range from a little below 0·04 to 0·05 ; those of green and yellow rays between 0·05 and 0·06 ; and orange and red rays from 0·06 to nearly 00·8 ; rays longer than 0·07 being, however, found only in light directly from the sun or other intense source.

It appears, then, that the foregoing test objects are as minute as the wave-lengths of visible light. Indeed, if the determinations can be depended on, the last two are even somewhat smaller than the shortest visible vibrations. This, if it can be established, is a very unexpected fact. The best way of testing it would perhaps be by one of the finer of Nobert's scales. If any member of the Club have such a scale he may convert its measures into metrical measures, by allowing 2·256 millimetres (which is the same as 225·6 Vth-metres) for each line or twelfth part of the obsolete Paris inch made use of by Nobert.

If, as appears to follow from theory, light of wave-lengths longer than the intervals between markings is inoperative, it would appear that it must be positively mischievous, by producing a haze of brightness through which the markings are to be dimly made out. Accordingly, in scrutinising striæ separated by an interval of 0·07, such as those of *Pleurosigma formosum*, the full light of the lamp may perhaps be used with advantage ; but in examining such markings as those of *P. hippocampus*, with an interval of 0·06, it would appear that the red rays at least should be cut off; and that, when the object is so small as the markings of *P. angulatum*, viz. 0·05 and under, none but blue, violet, and indigo rays should be permitted to pass. There seems to be some ground for hoping that by this treatment these difficult objects will become more manageable. Blue shades have sometimes been used by microscopists, but, apparently, without knowing why or under what circumstances they are of service. Glasses coloured blue by cobalt have the disadvantage that they transmit red rays, and on this account the ammonio-sulphate of copper*, which allows only rays of high refrangibility to pass, will probably be found a much better absorbing medium.

* This invaluable absorbing medium is prepared in a few minutes by dissolving a little sulphate of copper in water, and adding liquid ammonia until the white bulky precipitate, which first forms, is redissolved. If a dilute solution be wanted, water is to be added, which causes a dark precipitate, and then ammonia, until the precipitate is nearly dissolved. The concentrated solution in a watch glass, or a dilute solution in a tube closed by plate glass ends, will be found to answer.

From the foregoing considerations it seems natural to conclude that details too minute to be *seen*, may perhaps be made out by photography, and especially by those photographic processes which employ almost exclusively rays beyond the violet, rays ranging in wave-lengths from 0·03 to 0·04. The well-known photographic experiment of Mr. Wenham on the honeycombed markings of *Pleurosigma angulatum* seems to verify this anticipation.

But whether these particular expectations shall come to anything or not, the circumstance that subjects well worth inquiry are continually presenting themselves, when we use a convenient set of measures, will surely be held sufficient to recommend their adoption by every member of the Club.

Manchester Literary and Philosophical Society.

MICROSCOPICAL AND NATURAL HISTORY SECTION.

January 7th, 1867.

A. G. Latham, Esq., President of the Section, in the Chair.

The President exhibited mounted specimens of Foraminifera from Dogs Bay, Roundstone, and from Berwick Bay, and he remarked on some differences in the character of the two deposits. He pointed out that in the Dogs Bay sand the prevailing forms are Truncatulina and Miliolina, while in the Berwick Bay dredging they are Dentalina and Biloculina. He also remarked on the great difference in the quality of the shell of Truncatulina from these two localities, those from Dogs Bay being delicate and hyaline, while those from Berwick Bay are opaque and very thick and strong.

The following paper, "On *Polymorphina tubulosa*," was read by Dr. Alcock.

In the course of examinations of the Dogs Bay sand I have collected great numbers of detached branches of *Polymorphina tubulosa*, a form of foraminifer which is not likely ever to be found perfect in shore sand. I have, however, met with several fine specimens of it with only the tips of the branches broken away; but the most interesting examples are some which are more damaged, and show several structural features difficult, if not impossible, to be seen in perfect specimens. The main body of the shell of *Polymorphina tubulosa* has the form of Professor Williamson's *P. communis*, and appears to be identical with it, this form only, so far as I have seen, taking on the peculiar final development characteristic of *P. tubulosa*. It consists in the mature state of the rounded shell of *P. communis* more or less concealed by several covered passages commencing at the mouth and taking a direction towards the base of the shell. These passages have their arched

walls developed into tubular prolongations, extending in all directions, and soon dividing irregularly into small branches, which, in one or two instances in the specimens shown will be found to anastomose; they are either closed at their tips, as a small glass tube might be closed in the flame of a blowpipe, or they expand into little cauliflower-like excrescences, which are also apparently closed. The shell composing the parts just described is very delicate and thin compared with that forming the rounded nucleus, and its outer surface is frosted with small glassy projections of an irregularly squared figure, like imperfectly formed crystals. It is evident that this is a hastily deposited shell-covering on the sarcode developed since the last regular chamber of the shell was formed, and which, instead of collecting itself into a definite shape to produce a chamber similar to the others, had been surprised, as it were, while fully expanded by the calcifying process, which consequently gives us a petrified representation of the ordinary appearance of this external sarcode, with its pseudopodia protruded, the probable suddenness of the process being illustrated by the cauliflower excrescences which terminate many of the branches, and which have resulted from the contraction of the extremely fine terminal filaments of sarcode. It would appear that this is the final act in the life of the Polymorphina, its enfeebled vital power being insufficient to gather together the sarcode for the formation of another regular chamber, and therefore, properly speaking, the shell is fully formed and perfect before this last addition is made to it. There is evidence, however, in the specimens I have now to show, that the animal must have lived for a considerable time in a full-grown state before it thus terminated its existence, by producing a permanent likeness of its living self. These specimens have their arched coverings, with the branches proceeding from them, more or less broken away, so as to expose the floor beneath them, which consists of parts of the strong outer wall of the rounded nucleus, and which in all the cases examined presents the same peculiar appearance. It is riddled through with many large holes sometimes nearly circular, but oftener oval or kidney-shaped, and so numerous as to open a very free communication between the external sarcode and that in the interior of the shell. It is not unusual to find Polymorphinas of a different type from these with a few small round holes in their outer walls, but they are scattered irregularly, are few in number, and have no evident relation either with one another or with any structural peculiarity of the animal; whereas in the present case they are invariably contained within the area of the floor of the covered passages, and are so numerous and encroach so much on each other that in some parts they leave only narrow isthmuses of the original shell-wall between them, and the larger holes have every appearance of having been formed by the union of several smaller ones. It is evident from a consideration of their character that they have been produced by the removal of shell-material previously deposited, and this gives them a physiological interest,

for though it is natural to suppose that a creature which has the power of precipitating carbonate of lime on its surface would also have the power of removing portions of it by solution or absorption if required, the Foraminifera are so structureless that we should hesitate to attribute to them this function without clear and positive proof.

In order to follow the successive changes in the latter part of the life of this Polymorphina, as they are illustrated in the specimens before you, the large rounded shells of *P. communis* should be first noticed, in which no opening is perceptible excepting the mouth, showing that at this stage the numerous large holes which are afterwards formed have no existence. The great thickness of the outer walls compared with that of the internal parts of the shell shows that the animal must have existed for a considerable time in this condition, during which the surface has been strengthened by repeated deposits of calcareous matter from its coating of external sarcode, and the smoothness and evenness of this surface shows that the coating was at that time spread uniformly over the whole of it. But broken specimens of *P. tubulosa* show that a change in the disposition of the external sarcode has been afterwards made, for in these it is found to have collected itself into two or three irregular bands, always commencing by one end at the mouth and extending towards the base of the shell, an arrangement clearly mapped out by the remains of its ultimately formed shell-covering, fragments of which are seen still attached to the surface of the smooth rounded nucleus.

The next event in the life of this Polymorphina is the formation of those numerous openings through the thick shell-walls, the observation of which in the specimens before you has chiefly led me to introduce them to your notice. These show, by their definite position and the evidence they give of their progressive formation, that when the external sarcode has once taken the form of bands it remains permanently in that state, and that these bands hold a fixed position on the parts of the shell where they were first placed. Among the specimens shown are some which only differ from ordinary shells of *P. communis* in being remarkably smooth on the surface and in having numerous large holes arranged in several rows radiating from the mouth towards the base of the shell, exactly as in undoubted specimens of *P. tubulosa*, but they are without the slightest trace of the external arched coverings and tubular branches. These might at first sight be set down as very much rolled and worn specimens of the ordinary *P. tubulosa*, but there is no evidence in the Dogs Bay sand of other kinds of Foraminifera being worn to the extent which would be necessary to produce such a result, and the suggestion is uncalled for in this particular case, since it is evident that at one part of the life of the animal its shell must have presented the appearance of these specimens, unless it could be admitted that the holes are formed after the production of the shell-covering on the expanded pseudopodia. But this last is clearly a single act, and its plan is

evidently not such as would be adopted if the protection of sarcode were the object in view, the subdivision into many projecting branches most delicate and fragile at their points exposing it as much as possible to every injury, and therefore presenting a form and arrangement not at all likely to promote the comfort and convenience of the animal if it were to exist long in that state; and when to this we add that the pseudopodia, which are the means by which the Foraminifera communicate with the external world, are sheathed by their shell-covering so as to be incapable of action, and moreover that every part of the animal becomes completely enclosed, the conclusion seems inevitable that this is not a condition in which it passes any considerable portion of its life, but that it is, as already suggested, merely the closing and final act. The holes through the thick shell, however, present a different history; they show by the quantity of shell-material removed and by the way in which separate holes have run together, that time has been spent in their formation, and they have also a clear and intelligible use in the economy of the animal, this being to open free communications between the internal and external sarcode. As to the process by which the shell-matter is removed, it seems impossible under the circumstances to suppose it done in any other way than by absorption by the sarcode in contact with it. Among the specimens shown is one of *P. tubulosa* which has been completely broken open, and shows that the process of absorption is not confined to the outer walls, but that the inner partitions, which at first formed parts of the walls of the separate chambers, are also in great part removed, throwing the whole of the interior into one large irregular cavity.

The quantity of carbonate of lime deposited at once in the covering of the external sarcode and its pseudopodia is so considerable that some unusual source might naturally be looked for to supply it, and this is apparently found in the shell-material redissolved by the process just described, which must eventually lead to the sarcode being excessively charged with mineral matter and may be considered a sufficient reason for the final catastrophe; and if the view here given of the later stages of the life of *Polymorphina tubulosa* be correct, it adds another point of interest by showing that the deposit of shell-material, in this one case at least, is more of a chemical than a vital act.

ZOOPHYTOLOGY.

AMONGST numerous specimens of Polyzoa and Sertularians, chiefly from the Cape of Good Hope and Australia, with which we have been lately favoured by Mrs. Gatty and by Miss E. Gore, are many new species, which we hope to be able in due course to describe. On the present occasion we give four of these.

I. Class—POLYZOA.

Sub-Order 1. CHEILOSTOMATA.

Fam. 1. BICELLARIADÆ, Busk.

Gen. *Bugula*, Ok.

B. cucullata, n. sp. Pl. XXXVI, figs. 1—6.

Cells biserial, elongate, subpyriform; aperture occupying about two thirds of the length of the cell; a short spine at each upper angle, and a smaller one on the outer margin a little way below the angle; ovicell very shallow, cucullate, or saucer-shaped; avicularia sparse, affixed usually on the outer side of the cell.

Hab. Australia, *Miss Gore;* Western Australia, *Mrs. Gatty*.

The polyzoary of this pretty species is white. It appears to attain several inches in height, the branches being short and fan-shaped. In general habit and mode of growth it closely resembles *B. avicularia,* from which, in fact, it is distinguished chiefly by the peculiar saucer-shaped form of the ovicell, and the extreme rarity of the avicularia, which organs, however, are, as usual in the family, of the capitate form.

Fam. 2. FLUSTRIDÆ.

Gen. *Chaunosia*, n. gen.*

Cells sejunct, attached apparently only by long tubular fibres.

C. hirtissima, n. sp. ?

Cells ovate, elongate, suberect, very convex behind; aperture occupying the whole front of the cell; mouth at the summit, cresentric above, border simple; margin of the aperture and the entire surface of the cell behind

* χαῦνος, *laxus.*

covered with numerous long spines, many of which are bi- or trifurcate; polyzoary composed of narrow ligulate, or subcylindrical, irregularly dichotomous, lax branches; ovicells —— ?

Diachoris hirtissima? Heller, 'Verhand. d. k. k. bot. zool. Gesellsch. in Wien.,' xvii, 1867, p. 18. Pl. i, figs. 6, 7.

Hab. Cape of Good Hope, *Dr. Rubidge.*

This is a very curious form, and we are not sure that it is not identical with a species recently described by Prof. Cam. Heller, from the Adriatic. But as we have not been able to perceive the six connecting links of the cells characteristic of the genus *Diachoris*, in our specimen, we have thought it better for the present to regard the two as distinct. Prof. Heller figures and describes the connecting-tubes in his *Diachoris hirtissima* so clearly that he cannot have been mistaken in seeing them. At the same time, the general resemblance of his species with ours is so striking that it is almost impossible to believe that they can be distinct. Should the mode of intercellular connection be as he states it, there can be no doubt that *Chaunosia* (χαῦνος, *laxus*) must be merged in *Diachoris.*

Sub-Order 2. CYCLOSTOMATA.

Fam. DIASTOPORIDÆ, Busk. ('Crag Polyzoa,' p. 113.)

Gen. *Tennysonia*, n. gen.

Polyzoary arising from a rather thick central base (substipitate); lobate, stelliform; lobes curved, with a median angle; tubes wholly immersed; orifices disposed in straight lines, extending from the median angle to the denticulate margin of the lobes; interspaces cancellous.

Hab. Cape of Good Hope, parasitic upon *Onchopora tubulosa. Dr. Rubidge* (*Mrs. Gatty*).

This is an extremely beautiful form, which is provisionally referred to the family Diastoporidæ, in which it appears to be most closely allied to *Discoporella*, Gray (as defined in 'Crag Polyzoa,' p. 115). In that genus, however, the polyzoary is normally sessile or adnate, and of a disciform shape, sometimes rising into more or less of a cone, and the tubes are not wholly immersed, but have their notched or toothed mouths usually considerably exserted. In *Defrancia*, which is closely allied to *Discoporella*, the orifices of the immersed tubes are placed on elevated ridges, radiating more or less regularly from the centre of the discoid polyzoary, the interstices being sometimes cancellous, as they are in some species of *Discoporella*.

The polyzoary of *Tennysonia*, which is represented of the size of nature in fig. 10, is of a pale rose tint, and semitransparent, whence it has a very elegant appearance. The generic name is given to this species at the express desire of Mrs.

Gatty, to whom we have on many occasions been deeply indebted for interesting additions to the number of species, more especially of polyzoa. We presume her intention is to combine the name of our great poet with certainly one of the most beautiful objects in the class to which *Tennysonia* belongs.

Sub-Kingdom CŒLENTERATA.

Class ACTINOZOA. Order ASTEROIDA.

Fam. CORNULARIADÆ, n. fam.

Gen. *Cornularia*, Lamk.

C. australis, n. sp. Pl. XXXVI, figs. 7, 8.

Cells smooth, or slightly wrinkled only at base; white.

Hab. Australia, *Miss E. Gore.*

The only original figures of *Cornularia* with which I am acquainted are those by Cavolini ('Mem. terza,' pl. ix, figs. 11, 12); for that given by Lamouroux ('Exposit.,' pl. lxxviii, fig. 4) is a bad copy of Cavolini's fig. 12, in which the transverse wrinkling of the cell-walls is omitted, although this condition enters into the specific character, whilst Blainville's figure ('Actinol.,' pl. lxxxii, fig. 4), though slightly altered in position, is evidently merely a copy from Cavolini. Fig. 11 of Cavolini represents the cells of the natural size, spreading over the surface of a *Balanus;* and in his description (loc. cit., p. 250), under the name of *Tubolara cornocopia*, (*Tubularia cornucopiæ*, Pallas), he states that it is found upon pebbles and *Balani*, though he observes that Pallas, who appears to have been the first to notice the species, had met with it dry on other marine productions. It is possible, therefore, that *Cornularia cornucopiæ*, as it ought to be named, may occur on fuci as well as upon hard bodies at the bottom of the sea. Cavolini's admirable description of the genus has left scarcely anything to be added by subsequent observers, and his figures suffice to show the distinctness of Pallas's species from that we have described above. The differences, so far as they can be determined from the scanty means at present in our power, seem to consist in the smooth, even, white walls of the cell in *Cornularia australis*, which in *C. cornucopiæ* are more or less wrinkled ("per totam longitudinem rugis annulosi), and, according to Cavolini, of an orange colour (" un colore che si accosta a quello dell' arancio") (lutei, Pallas). We have also been informed by Prof. Allman, who is well acquainted with the Mediterranean species, that *C. australis* is distinct from it.

ZOOPHYTOLOGY.

DESCRIPTION OF PLATE XXXVI.

Fig.

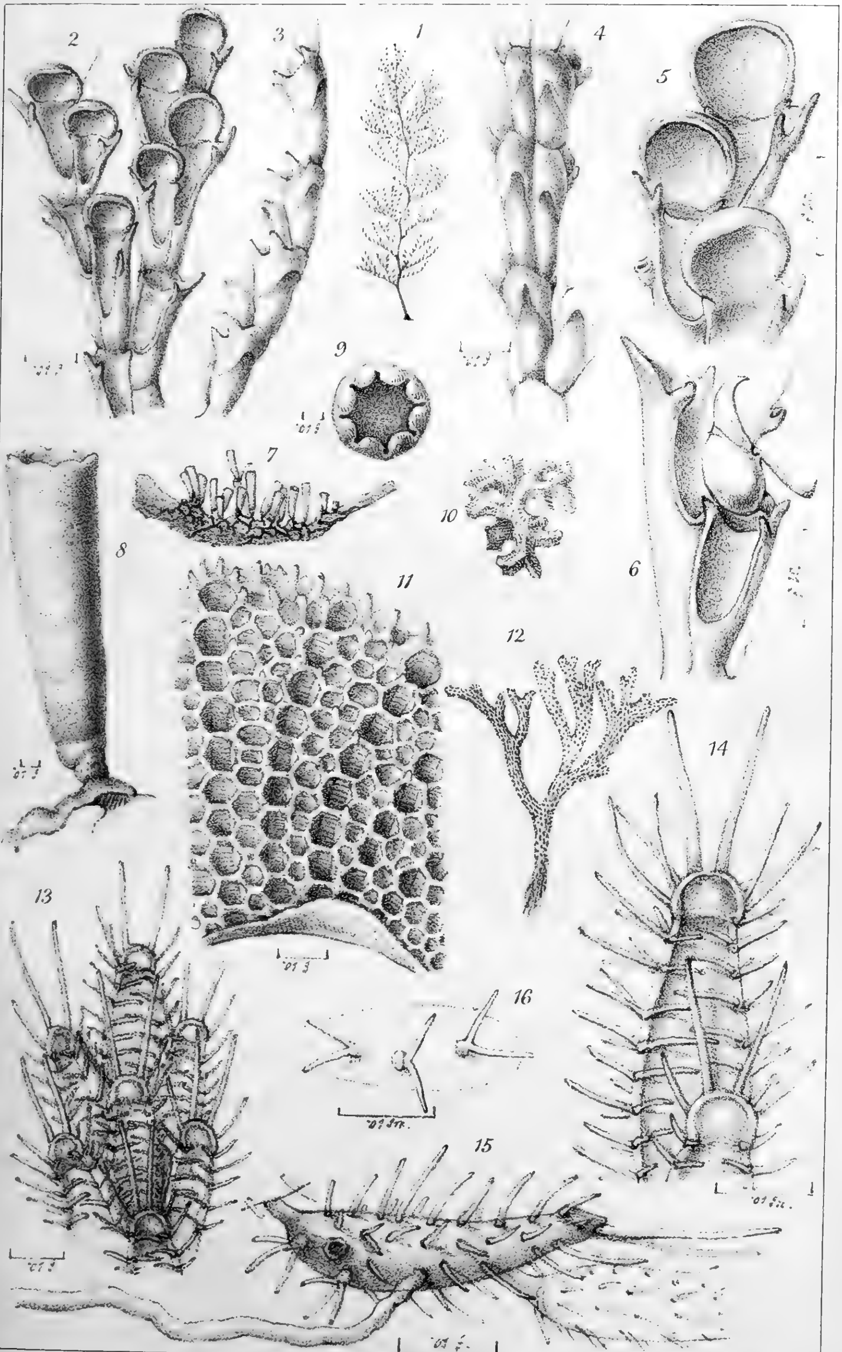
1— 6.—*Bugula cucullata.*

7— 9.—*Cornularia australis.*

10, 11.—*Tennysonia stellata.*

12—16.—*Chaunosia hirtissima.*

Plate XXXVI.



Tuffen West del. et lith.

W West imp.

ORIGINAL COMMUNICATIONS.

On New Forms *of* Diatomaceæ, *from* Dredgings *off the* Arran Islands, Co. Galway. By the Rev. Eugene O'Meara. Second Series.

In my first communication on this subject I ventured to express my opinion that a more careful examination of the material would lead to the discovery of other new and interesting forms, and I have now the gratification to inform you that my anticipations have been fully verified. I have been engaged from time to time, as opportunity was afforded, in examining the material, with most satisfactory results. Some few of the forms recently discovered I shall now submit to your notice.

Coscinodiscus fasciculatus, n. sp., O'M., Pl. VII, fig. 1, × 600.—Diameter ·0033. Valve areolate, the areolæ or cellules arranged in parallel bundles, about sixteen in number. Each bundle contains nine parallel moniliform lines; the central line reaches from the centre to the circumference, the next lines on either side of the same length, each successive pair terminating at a greater distance from the centre.

This form is exceedingly rare; only one specimen has as yet come under my notice, and this an imperfect one, but still sufficient to indicate the characteristics. It is, therefore, not without some misgiving I venture to notice it, although the marked peculiarities of it, as I consider, justify me in doing so.

In respect to the fasciculate arrangement of the areolæ, there is a great similarity between this species and *Coscinodiscus symmetricus* and *C. Normanni*. The areolæ, however, are smaller than in the former species, and larger than in the latter.

Eupodiscus eccentricus, n. sp., O'M., fig 2, × 800.—Diameter about ·0014. Surface of the valve distinctly areolate. The areolæ, which are larger towards the centre than towards the circumference, are arranged eccentrically. There is a marginal blank space, in which the processes, about twenty in number, are placed at equal distances.

Stauroneis rhombica, n. sp., O'M., fig. 3, × 600.—Length of the valve ·0017, greatest breadth ·0012; rhomboido-elliptical, with narrow lanceolate apices. Striæ very fine, punctate, and parallel; stauros narrow, the transverse limb of uniform breadth, and equal in length to half the breadth of the valve.

Stauroneis costata, n. sp., O'M., fig. 4, × 600.—Length of the valve ·0021, breadth ·0009. Narrow elliptical, rounded at the ends. Striæ distinctly costate, and gently waved, the transverse limb of the stauros short, and of equal breadth throughout.

Cocconeis clavigera, n. sp., O'M., fig. 5, × 600.—Valve broadly elliptical; length ·0014, breadth 0011. Striæ costate; the costæ radiate, club-shaped, very fine at the median line, and gradually expanding towards the margin, not reaching the margin.

Cocconeis Wrightii, n. sp., O'M., fig. 6, × 800.—Valve broadly elliptical; length ·0017, breadth 0012. A narrow border is closely studded with slightly elongated cellules. The central nodule is expanded in the form of two crescents, touching at their convex centres, and radiating towards the apices. Striæ moniliform, arranged in curves nearly parallel with the limbs of the crescent-like expansions of the central nodule.

Cocconeis Portii, n. sp., O'M., fig. 7, × 800.—Valve very minute; length ·0009, breadth ·0007; broadly elliptical, with a narrow border. Striæ radiate, punctate. The puncta very minute at the median line, and gradually enlarging towards the outer margin. The median line broad.

Rhaphoneis liburnica, var., fig. 8, × 600.—Valve broadly elliptical; length ·0018. Striæ radiate; the cellules, which are not more than six in the longest stria, appear slightly projecting above the surface of the valve, are quadrangular at the base, narrower and rounded towards the top; raphe narrow elliptical; valve without border; margin striated. At first I was disposed to regard this form as a distinct species, but on consideration preferred to refer it to *Raphoneis liburnica*, Grunow. The specific description of *R. liburnica* given by that author agrees with the general characters of this form, but the hispid appearance of the cellules and their quadrangular figure at the base entitle it to be regarded as a variety.

Rhaphoneis suborbicalaris, n. sp., O'M., fig. 9, × 600.—Valve nearly orbicular; length ·0022, breadth ·0019; divided into compartments by short costæ, eight on one side, nine on the other, alternately disposed. The spaces between the

costæ filled up by three lines of punctæ, the two outer lines reaching the central vacant space or rhaphe, the intermediate line much shorter. This species, in its general characters, very much resembles a form figured by Grunow, and with hesitation regarded by him as a variety of *Cocconeis Grevillii*. The absence of a median line and central nodule, as well as the presence of a distinct raphe, mark the present form as belonging to the genus Rhaphoneis. The form figured by Grunow is narrow elliptical; mine is nearly orbicular. These differences notwithstanding, I am disposed to think that Grunow's form and mine are at most but varieties of the same species.

Rhaphoneis Jonesii, n. sp., O'M., fig. 10, × 600.—Valve broadly elliptical; length ·0018, breadth ·0014. Striæ radiate, moniliform; cellules close, compressed, very large at the margin, and gradually decreasing in size towards the raphe, which is narrow and elliptical.

Rhaphoneis Moorii, n. sp., O'M., fig. 11, × ·600.—Valve broadly elliptical; length ·0016, breadth ·0011. Striæ radiate moniliform cellules of the same size throughout, raphe narrow. At first inspection of the figures it might appear that this form is identical with the preceding, but on consideration the differences are so great as to warrant me in regarding them as distinct species. The raphe in the former, though narrow, is wider than in the present. The former has a distinct border, this has none; but the most marked difference is to be found in the character of the striæ; in the case of *R. Moorii* the cellules which form the striæ are all of nearly the same size, round, and distant; whereas in the case of *R. Jonesii* the cellules are so close as to give a costate appearance to the striæ; they are also flattened, and decrease in size from the margin towards the raphe.

Rhaphoneis Archeri, n. sp., O'M., fig. 12, × 600.—Valve elliptical. Striæ slightly radiate, distinctly costate, distant; raphe lanceolate. A form described by Grunow, and by him called *Rhaphoneis scutelloides*, so far as the figure is concerned, so closely resembles the present that at first I was disposed to regard mine as identical with it, but from the description there is no doubt it is distinct. The striæ of *R. scutelloides* are described by Grunow as "indistincté punctæ;" in *R. Archeri* they are distinctly costate.

An Account *of a* Trichopterous Larva.

By C. S. Tomes, B.A. Christ Church, Oxford.

(Pl. IX.)

During the early part of the summer of 1866 the larvæ which I propose to describe were noticed in the midst of a mass of Conferva growing in a pond at Hampstead. Several specimens were at that time kept under observation, but were not then described, as I hoped to succeed in tracing them to their adult form. As I have little hope of again obtaining specimens, the pond having since been drained, I now venture to offer a brief account of them, there being, so far as I have been able to ascertain, no careful description as yet published.

In the January number of this Journal it is mentioned that somewhat later in the summer of 1866 Dr. John Barker exhibited before the Dublin Microscopical Club a larval form in many respects similar to that now under consideration. The larva, however, exhibited by him is spoken of as "Dipterous," whilst that which I now propose to describe is clearly referable to the order Trichoptera, a difference which renders it possible that the creatures may not be identical, and, in any case, for the purposes of identification, makes a careful description of that which has fallen under my notice desirable.

The larva is nearly $\frac{1}{5}$th of an inch in length, of elongated form, and a pale greyish-yellow colour; it is covered, more especially about the head and legs, with long hairs. On the head and thorax are a few brown spots, disposed with some regularity. The head and thoracic segments, which in the usual position of the larva are protruded from the slit-shaped opening at either end of the case, are protected above by hard plates, whilst the abdominal segments (with the exception of the expanded caudal segment) are covered by soft integument. (Plate IX.)

The antennæ are very small; the labrum presents no marked peculiarity; the maxillary palpi, as in other allied larvæ, are not distinctly recognised, but the maxillæ carry appendages which are probably sensory and represent them. The mandibles are strong, and are shaped somewhat like the blade of a pair of nail scissors. The labinm carries distinct palpi.

The second and third pairs of legs are about one quarter the length of the body, the first pair being shorter and stouter. Mr. Tuffen West has suggested that the crustacean-like form of the limbs (which is most marked in the first pair),

certain of the joints being greatly expanded and abruptly cut off at their point of junction with the succeeding joint, may adapt them to separate filaments of Conferva at their joints, so as to preserve the integrity of the cells. Whether this be so, fresh observation of living specimens alone can decide; I have not observed the limbs so used, though I have often seen filaments bitten across by the strong mandibles, the legs being employed to gather together and hold a bundle of filaments which were sorted over by the mouth. The legs are fringed with fine hairs, which doubtless greatly increase their efficacy as swimming organs, and are terminated by long hooks.

The abdominal segments are much larger than the thoracic; none of them carry appendages, nor are there any external branchiæ.

The caudal segment is expanded and flattened, so as to form a quadrangular plate, the terminal corners of which are each armed with a hook; it is by means of these hooks that the larva retains its hold of the case.

The case is of oblong form, with rounded ends forming slit-shaped openings; it is much flattened from side to side, and is about three times as long as it is broad. It is formed of closely woven, silky fibres, and perfectly translucent. Upon the outer surface of the sides, which are slightly convex, is a layer formed by concentrically arranged filaments of Conferva, entirely concealing the inner silky case, except for a small space at the centre of each side, where the Conferva is less closely coiled.

The general direction of the filaments is parallel to the outline of the case; diagrammatically, the arrangement of the individual filaments may be represented by two letters U placed thus $\begin{smallmatrix}\cap\\ \cup\end{smallmatrix}$. And herein lies the clue to the manner in which the Conferva is applied—the larva, which is represented in the accompanying figure in its habitual position, with the head and legs protruded from the slit-shaped opening at either end of the case, never voluntarily quits its shelter; and if removed from it, manifests the greatest anxiety to regain it. Hence the filaments of Confervæ are all applied to the outer surface of the silky case (to which they are attached by numerous threads) by the larva working always from one end. Now, the larva cannot reach from either end much further than to the middle of the case; accordingly, we find the ends of the majority of the filaments near that point; the filament is carried in a U-shaped curve to the end of the case, returns down the other side, and terminates at a point nearly opposite

to that at which it began. When the case has attained a certain size much shorter filaments are employed, and these are arranged in more open curves across the ends, thus lengthening the case without increasing its breadth.

The Conferva remained green, and appeared to flourish perfectly in its new situation; the separation of the filaments having been always at the joints, as Mr. Tuffen West pointed out, there were no injured cells to decompose on the larva case. The larvæ swam about easily, seemingly but little encumbered by the cases, which were held with the flat sides vertical.

Whilst in my possession the larvæ manifested the most ceaseless activity, sorting over and biting off filaments of Conferva; after working for a time at one end, they would suddenly bend upon themselves, pass down the inside of the case, and resume their task at the opposite end. They were, as far as I could tell, strictly herbivorous. Eventually the ends of the case were closed up, and it was attached to some stick or plant near the surface of the water; unfortunately, none of my specimens survived beyond this stage; I have, however, found the empty cases gnawed through near one end, but have failed in discovering the adult form.

There can, nevertheless, be but little doubt that this larva belongs to the genus Hydroptila; the case which it forms corresponds in essential particulars with those described by M. Jules Pictet,* in the following terms as peculiar to this genus, "qui vivent dans les étuis applatis, en forme de rein, ouverts par deux fentes, composés d'une soie solide." The larva does not, however, correspond exactly with any description there given, nor does the case precisely resemble in form any there figured; that which it approaches most nearly being a larva the perfect form of which was not known.

The larva of *H. pulchricornis* resembles that now under consideration in general form, and in the possession of the hooked caudal plate; it differs in having scale-like appendages on the 3rd, 4th, 5th, and 6th abdominal segments, in having shorter legs of uniform length, and in the form of its case, which is kidney-shaped.

The larva of *H. flavicornis* bears a closer resemblance, but constructs a case terminated at one end by a point.

The larva of *H. Brunneicornis* is not, as far as I can ascertain, certainly known. These larvæ are described as making little addition to the exterior of their silky cases besides a few grains of sand, which would not require any very

* 'Recherches pour servir à l'Histoire et à l'Anatomie des Phryganeides.'

methodical arrangement; and although it is well known that Phryganea larvæ may, in the absence of their proper materials, be forced to use others, I am still inclined to regard the presence of the layer of Conferva as a distinctive character; for there are few other materials accessible to these aquatic larvæ which possess the pliancy requisite for the arrangement adopted, and it appears to me to be in the highest degree improbable that a larva which, under other circumstances, might have used other materials, should have, out of this Conferva, constructed a case displaying such exquisite symmetry.

One other supposition requires notice. It is possible that some of the larval forms of *Hydroptila* which have been described as forming a simple silky case might have afterwards adapted a layer of Conferva to its outer surface. An examination of the central parts of the sides of the case before us, suggests that the silky case was constructed up to a certain size before any Conferva was applied to its outer surface. I have not been fortunate enough to see any specimen in so early a stage, but I can speak positively as to the contemporaneous addition of silk and Conferva in the more advanced stage. And from the analogy of the construction of the cases of other Phryganeidæ, it seems unlikely that the manufacture of the silky case should, to any considerable extent, precede the addition of the Conferva to its outer surface; and I am inclined to think that the few irregularly disposed filaments which may be observed at the centre of each side mark the period at which the contemporaneous addition of the two materials commenced.

In conclusion, I beg to thankfully acknowledge my obligation to Professor Westwood, to whom I described the specimens, for kindly aiding me from his large store of entomological knowledge.

New Species *of* Microscopic Animals.
By T. G. Tatem.

I.—*Chætonotus longicaudatus* (mihi) is by no means uncommon in some of the ponds in the neighbourhood of Reading, and is altogether an elegant creature in its proportions and movements, and, as seen in the cage, stealing through the various patches of decaying vegetable matter, on which it feeds, remarkably resembles some of the viverrine animals. The body is smooth, elongated, and but little

dilated at the posterior extremity above the foot; the neck encircled by a ruff of reflexed setæ; head slightly trifoliate; eyes two, obsolete, but distinguishable as obscure punctæ; mouth infundibuliform, suctorial; æsophagus straight, longitudinally plicate (obvious enough when observed in the act of swallowing comparatively large masses of decaying vegetable matter); stomach an elongated cone, terminating in a short rectum and anus, opening just above and between the toes, which are very long and annulate; rotatory organ circular, abdominal, as in the other species of the genus; length $\frac{1}{80}$ to $\frac{1}{100}$. The figure which accompanies this is × 380. (Plate X.)

II.—The ponds and ditches of this neighbourhood afford, in greater or less profusion, two of the three known species of *Stephanops,* viz. *S. mutica* and *S. lamellaris*; more rarely, however, a fourth and undescribed species may be met with. Its range is a very limited one, even in this locality, one pool only, that in the King's Meadow, near this town, furnishing it in any numbers; but one specimen, so far as I yet know, having been obtained from any other. It is a remarkable form, and, though small ($\frac{1}{200}$), would not, if widely distributed, be readily overlooked by any microscopist.

The *Stephanops longispinatus* (mihi) is less active than either of the other two species known to me, swimming with a slow deliberate movement through the water, lowering its long dorsal spine to clear obstructions, and exhibiting none of the restless energy of either *S. mutica* or *S. lamellaris.* The lorica is oval, as seen in the dorsal view, expanding in front into a hood, which is narrower and deeper than in the other species; eyes two, frontal and widely separated; dorsal spine very long, articulated to the lorica by a ball-and-socket joint, erectile; foot of three joints, spined on either side, and terminating in short toes; rotary organ a wreath of short cilia within the hood; jaws of æsophageal bulb single-toothed; stomach apparently with several constrictions. Neither ovary nor contractile vesicle has been detected by me, having probably been overlooked.

III.—Occasional visits to Hastings have supplied me with a *Cothurnia,* which, though it may scarcely be accepted as a distinct species, must certainly be regarded as a notable variety of *Cothurnia maritima.* But one locality affords it, namely, a ditch of brackish water which extends for some distance by the side of the road leading from St. Leonards to Bexhill. But little if any difference can be observed between the animals of this and the ordinary form of

Cothurnia maritima. It is the lorica which alone diverges from the usual type, and which is, as shown by the drawing, longer, narrower at the upper part, and deeply notched on either side, in one or other of which the animal rests when extended.

The range of infusorial variability is at present but little defined—its extent, perhaps, scarcely suspected by microscopists; we are, therefore, but too much disposed to confer names upon and create species out of mere varieties. The *Cothurnia maritima* I figure, however, is certainly so remarkable a variety that I think it may legitimately enough be named *Corthunia maritima,* var. *incisa.*

The visitor to Hastings and St. Leonards will find the ditch I refer to, more particularly the broad end of it furthest from St. Leonards, a productive locality. Not only can a good gathering of Diatoms be obtained from it, such as *Pleurosigma elongatum, P. angulatum, P. balticum, Amphiprora alata, Achnanthes brevipes, Surrirella striatula, Epithemia constricta,* &c., but it abounds in many interesting forms of infusorial life—amongst them, *Tintinnus Cothurnia,* a Baltic species (which I now, I believe, for the first time record as British also), *Vorticella convallaria, Carchesium polypinum, Vaginicola valvata, Amœba crassa? Cothurnia maritima,* with its variety, the *C. incisa* (mihi), &c.

On MONOCHROMATIC ILLUMINATION. By J. J. WOODWARD, Brevet Lieut.-Colonel, Assist.-Surgeon, U. S. Army, in charge of Medical Microscopical Sections, Army Medical Museum.

SINCE 1865 I have been in the habit of using monochromatic (violet) light, not only for photo-micrography in my own hands and those of my able assistant, Dr. Edward Curtis, Assist.-Surgeon and Brevet-Major, U. S. Army, but also for all microscopic work requiring the sharpest definition, as, for example, the examination of the finest Diatomacea, the Nobert's lines, &c.

I obtain the violet light by passing the direct light of the sun through a saturated solution of sulphate of copper in aqua ammonia, as originally suggested by Von Baer, in his 'Einleitung in die Höhere Optik,' p. 48, the solution being held in a plate-glass cell, with parallel sides, and about the $\frac{1}{8}$th of an inch apart. The light thus obtained is concentrated

by the ordinary achromatic condenser, and the objects viewed preferably by objectives specially constructed for the violet ray, such as have been made for the branch of the Army Medical Museum at Washington, under my charge, by Mr. Wm. Wales, of Fort Lee, New Jersey. I find, however, that for ordinary achromatic objectives of *high power*, such as the $\frac{1}{16}$th, $\frac{1}{25}$th, and $\frac{1}{50}$th of Messrs. Powell and Lealand, of London, or the No. 11 immersion lens of Mons. E. Hartnack, of Paris, the special correction may be dispensed with, and good results obtained, which, however, in my opinion, do not exceed the performance of a Wales $\frac{1}{8}$th properly amplified. With any of these lenses thus illuminated, the 29th and 30th bands of Nobert's lines can be satisfactorily resolved; perhaps for this object the $\frac{1}{25}$th of Messrs. Powell and Lealand does best, but they are all very nearly alike. Since reading the papers of Count Castracane and others ('Microscopical Journal,' 1864, p. 249; 1867, p. 60, &c., &c.), I have carefully tried the violet ray obtained by a prism, but find that, although it possesses essentially the same qualities as that obtained in Von Baer's method, the loss of light and the trouble of manipulation render it inferior for practical purposes. (Plate X.)

Passing by the difficulty of manipulation—which might, perhaps, be overcome by proper mechanical contrivances—I limit myself here strictly to the question of loss of light.

Besides the loss of light from reflection at the surface of the prism, there is a certain definite loss due to the dispersion of the beam, a diminution which increases with the index of refraction of the prism, and also directly as the distance. Of course, therefore, the prism should be placed at as short a distance from the lower aperture of the achromatic condenser as will permit sufficient dispersion to give a violet beam adequate to the homogeneous illumination of the instrument. I found, with a large flint-glass prism in my possession, that about eight inches' distance was necessary for this purpose. The results were very satisfactory to the eye, although with high powers I soon satisfied myself that the light was not so great as I had been in the habit of obtaining by transmitting the solar pencil through the ammonio-sulphate cell. To obtain a definite photographic comparison, I resorted to the following simple experiment.

The solar rays were reflected by a plane mirror upon the prism, which was placed just outside the shutter of a darkened room. The arrangement was such as to throw the violet ray of the spectrum up a blackened tube into the dark room. At eight inches from the prism the violet light was intercepted by a concave amplifier, the mounting of which

closed the end of the blackened tube. The object of this lens was to increase the dispersion, and so to increase the time of exposure necessary to produce a decided impression on the sensitive plate. At two feet from the lens was the plate-holder. In front of the sensitive plate was a slider with an aperture, so arranged that two small areas of the plate could be exposed successively. The field being evenly illuminated, one of the areas was exposed for twenty-five seconds, when the plate was covered; an assistant removed the prism, slid in the ammonio-sulphate cell, and altered the position of the mirror, so as to throw the sunlight through the cell upon the concave amplifier as before. An even illumination having been obtained, the second area in the sensitive plate was exposed twenty-five seconds. On development it was found that the part of the plate illuminated by the ammonio-sulphate was several times blacker than the part illuminated with the prism. Using this sensitive plate as a negative, I obtained the print which I enclose, in which, of course, the lightest area corresponds to the darkest area in the original plate. My reason for using the amplifier to disperse the rays in both instances was that the exposure must otherwise have been instantaneous, and the slightest variation in time would have vitiated the results.

From a careful comparison of the two modes of illumination, and from the photographic experiment, I am compelled to conclude that the ammonio-sulphate cell offers greater practical advantages for the purposes of photo-micrography than the prism, the small quantity of the other rays which are transmitted by the ammonio-sulphate not interfering in the least with the results.

As, however, Count Castracane may be more skilful in his manipulation of the prism than I have been, I herewith transmit a photograph of *Pl. angulatum*, taken by myself with the Wales $\frac{1}{8}$th and amplifier, magnified 2544 diameters; one by my friend Dr. Curtis, by the same lens, with the same power; one by the latter with the Powell and Lealand's $\frac{1}{5}$ th, magnified 2344 diameters; and enlargements of the two latter to 19,050 diameters. These photographs I beg you to transmit to Count Castracane, whose address I do not know (though I have endeavoured to obtain it through Dr. Maddox), with assurances of my highest consideration, and with the request that he will send me paper proofs of his own best photographs of the same object as obtained by the prism.

By so doing you will confer a lasting obligation upon one who is anxious only to get at the truth in this interesting optical question.

TRANSLATIONS.

The Laws *of the* Movements *in* Microscopical Plants *and* Animals *whilst under the* Influence *of* Light. By Professor F. Cohn.

(Translated from a German pamphlet sent by Dr. Cohn.)

By microscopical animals Professor Cohn means only the Infusoria, and especially those mouthless genera of Infusoria which are provided with cilia. Those which are provided with mouths (Stomatoda of Siebold) bear in their definite motions, which are correlated with their taking up solid nourishment, a marked differentiating character. By microscopical plants only those genera are understood which are possessed of an independent power of migration, or of a developmental condition in which this is the case. Both classes taken together are to be termed merely "microscopical organisms."

In the researches, of which this is a summary, the question as to the primary cause of the movement, or the moving power, is not in any way at issue. Of whatever kind the power may be that puts a body in motion, it is easily seen that this movement may be made in every possible direction. If microscopical organisms exhibit in their movement a definite direction, then there must be some special cause which appoints the direction of the movement. This cause of the direction of the movements is light.

In colourless microscopical organisms light has no influence, and no appointed direction of movement is to be observed; these organisms appear to move in every possible direction.

In Diatoms and Oscillaria, one of which contains a brown (phœophyll) and the other a greenish colouring (phycochrome) matter, the influence of the light makes itself so far appreciable that they prefer the light to the dark, and therefore seek the surface in large numbers. A further influence upon the direction of their movements has not yet been shown. Upon an equally lighted surface the Oscillaria develop radially on every side from the dark central entanglement of threads, and grow equally over every side of

the glass vessel. In the same manner diatoms are found in every part of an aquarium, on the surface of the soil as well as on the walls, but are never met with in its deeper and darker parts.

Numerous experiments with green microscopical organisms, especially with Euglena, gave the following results:—If a drop of water, which is thickly and equally filled with microscopic organizations, be placed upon a glass slide, it will be seen, before many minutes, that many of the organisms will betake themselves to that portion of the drop which is turned towards the window, or even towards that part of the sky which is most lightened. They crowd around this side, which we may call the window side, and give the drop a deep green edge, whilst the rest of the drop is quite colourless and free from Euglenæ; and, indeed, they place themselves together, so that their heads lie parallel one to another towards the light, and their bodies are directed perpendicularly to the edge of the window. They cannot remove themselves from this position, but gradually dry up as the edge becomes evaporated.

If, conversely, the drop be now turned, so that that which was formerly the window side is now turned away from the window and directed towards the room, and so that the former room-side forms the window-side, an instantaneous struggle in the whole of the organisms will be seen for the purpose of turning themselves round. The foremost soon turn round and swim towards the new window edge, and the back ones follow one after the other. After two or three minutes, more or less, as they are free to move, the organisms are again at the window edge. This experiment can be repeated as often as one likes; the result is the same whether the drop lies on a dark ground or is lighted from beneath through the diaphragm.

If the drop be placed on the microscope stand, so that the half which is turned towards the window lies on a dark ground, and, on the contrary, that which is turned away from the window be lighted from underneath by the reflector, then it will be seen that the organisms swim towards the window edge, although the other half of the drop seems to receive more light, seeing that it is lighted from above and underneath at the same time. And even when the light which comes from above is weakened by placing a semitransparent body between it and the object—such as a thin piece of horn or oil paper—the objects will always go towards the window edge, and do this even when the full light of the reflector is thrown at the same time upon them from

underneath. But if the window side of the drop be entirely shaded by an opaque body, then the organisms pass away from the window edge and go to the room side. If the light from above be entirely impeded, and the drop be only lighted from underneath by the reflector, the organisms will assume no particular position, but exhibit disorderly movements equally throughout the drop. The same takes place if the drop has been some time completely in the dark; but if, on the contrary, when the light which comes from above is shut off, only a part of the drop be lighted from underneath by means of the reflector (through the apposition of a diaphragm which is smaller than the drop) all the organisms will swim towards the lighted point. If, for example, this point is in the middle of the drop, they will leave the edges and will crowd together in the middle of the drop.

If a basin be filled with water which contains numerous green organisms, they will congregate at the window side; but if this be shaded by an opaque plate being placed upon it, they will go away from the window side and collect towards the opposite side; and, indeed, they will often place themselves in a dark green line, obliquely through the surface of the water, on the boundary of the shadow which the plate has thrown.

From the experiments that have hitherto been mentioned one might come to the conclusion that it is the intensity of the light that rules the movements of the green organisms, and that they prefer the window side to the room side because it is strongly lighted. If so, it must be at once granted that a sensibility exists in these animals which can perceive the inexpressibly small difference of brightness between the two edges in a drop of only one millimètre. But in this way we could not explain the reason of the powerlessness of the light from underneath transmitted by the reflector, compared with the light falling from above, and still less the reason for their preferring the window edge, when the light is palpably weakened by a semitransparent body, to the light which is given by the reflector when working with all its intensity, and is therefore the stronger.

Further researches have proved that it is not the *intensity*, but the *direction* of rays of light, which governs the movement of microscopical organisms. All the above experiments were made in a room where the light fell on one side, and the drop was flat, and which only caused one direction of movement. In such a case the organisms always move themselves towards that edge which is turned to the source of the light. But in open air, where the light falls on every side,

no movement towards the edges takes place. In a tall vessel of water, which is lighted by the daylight coming from above, as usual, the organisms move upwards towards the surface of the water, and in the same way in ponds in the open air; on the other hand, by lighting only one side in a room, they go to the upper edge, which is the nearest to the window, and which is turned towards the source of the light.

If, on the contrary, we allow the light to fall underneath, or from a point in the side of a cylindrical vessel of water, in the organisms in the first case will move downwards and the latter sideways towards the source of light.

As soon as the light from above is moved away the organisms may be moved to any point by reflected light; for example, in a flat drop on a glass slip, when the rays fall parallel from underneath, they move equally downwards towards the bottom of the drop. By placing the reflector in an oblique position they are made to move towards the corresponding edge of the drop. If the reflector of the microscope presents a definite image of the crossbars of the window on the object-plate the green organisms arrange themselves accordingly, leaving the darker crossbars empty, and covering those liquid parts which correspond to the glass, thus giving a negative picture of the window on the object-plate.

From these and a great number of analogous experiments the following conclusions are drawn:

(1) The direction of the movements of green microscopical organisms is determined by the direction of the rays of light which fall upon them. The organisms move towards the source of light, exactly contrary, as if it were to the direction of the rays of light themselves. They are, as well as we can express it, attracted rectilineally by the source of light. Apparent exceptions to this rule are brought about simply by the form of the drop or mass of water in which the organisms are.

(2) These green organisms exhibit a polar relation to light; they place themselves always so that one half of the body, which is generally characterised by the want of chlorophyll, as well as by the attachment of cilia (which is called the head), is turned towards the source of light, and the opposite green half of the body (tail) is turned away from the source of light. When the light is shut off no particular position is assumed.

(3) All movements of green organisms are accompanied by a rotation of their bodies round the longitudinal axis passing through the head and tail. Whilst in the dark the organisms can turn from left to right, as well as from right to left,

and often change these directions; but a definite direction of rotation is given to them by the light. In Euglena and some other organisms this is a contrary course to that of the hands of a watch, but the same as the rotation of the earth.

(4) Experiments with coloured glass show that only the more highly refractive actinic rays induce this direction of movement; the less refractive rays, which have no chemical activity, are simply negative in action, as in the absence of light. The organisms are attracted most strongly by the blue rays, whilst the red are the same as total darkness. Thus, for example, if half the field be lighted by blue, and the other half by red light, the organisms will all go to the blue, although it be turned away from the window-edge.

(5) By far the majority of green organisms follow the laws here laid down. There are, however, great numbers of exceptional forms which turn away from the source of light by a backward motion. In these organisms the rotation along the longitudinal axes is reversed, and there is a point, sooner or later, where they suddenly stop in their backward movement and stand still for some time, and then, by changing the direction of rotation, go over again towards the source of light.

(6) If we consider these facts concerning the movements of organisms which possess a green and a colourless half in connection with the property of chlorophyll to effect, through the agency of actinic rays, certain chemical actions—in particular the decomposition of carbonic acid and the separation of oxygen—it appears probable that all these phenomena of movement, as far as concerns their direction being caused by light, depend upon the chemical activity of these bodies. We can, in fact, imitate, by pure chemical processes, with the help of what may be called an artificial Euglena (namely, a fusiform fragment of chalk, half of which is covered with a resinous cement, and which is placed in diluted sulphuric acid), many of the phenomena recorded above. The splinter of chalk develops oxygen on its uncovered half, and is thereby projected by the backward impulse in the direction of the covered end, and is caused to rotate.

Description *of a* Live-box *for the* Observation *of* Living Tadpoles *and other* Animals. By F. E. Schultze, of Rostock.

(From the 'Archiv. f. Mikroskop. Anatomie,' II, p. 378.)

In the first part of Vol. xxxv of Virchow's 'Archiv' (January, 1866) doubts were expressed by A. Böttcher, of Dorpat, with respect to the spontaneity of the changes in form and place of the so-termed contractile cells, his doubts having arisen from a strict scrutiny into the method hitherto followed in the investigation of the motile phenomena of cells, and especially of the effects of the so-termed "wet chamber;" and he has suggested the possibility "that the amæboid motions, as they are exhibited on the stage of the microscope, may be caused by external influences independent of the vitality of the cells."

In order to meet an objection of the same kind, v. Recklinghausen * had already investigated and described the motile connective-tissue-cells in the tail of the *living* Tadpole. Having been for some time past engaged in the observation of these movements in uninjured, living animals, I am able in all essential points to confirm v. Recklinghausen's statements; and will here confine myself to a brief description of an apparatus adapted to the convenient observation of the changes in form and place of the connective-tissue-cells in the actually living state, which I have employed for a long time, and which is equally well adapted for other researches in living vertebrate animals.

Glass slides of some thickness are provided with peculiarly formed depressions opening on the upper surface, and having for their object the reception of the thicker part of the body of the animal to be examined, and its retention surrounded with water. The deeper depression intended for the admission of the trunk of the animal may be continuous, with a shallower one for the reception of the tail when that part is of any thickness, and it is desired to examine it without pressure. The shape and size of the hollow must, of course, correspond with those of the object. For the Tadpole of the Newt I have found a hollow constructed, as shown in the accompanying figures, very suitable.

Fig. 1, representing the bearer as seen from above, and

* "Ueber Eiter-und Bindegewebskörperchen," Virch. 'Archiv.,' xxxviii, pp. 174 and 175.

fig. 2 a longitudinal section. It is particularly advantageous to bevel off, beneath, that end of the cell at which the head of the animal is placed, whose movements are thus effectually prevented. The caudal extremity, in order to ensure its lying flat in the shallow part of the excavation, must be slightly twisted at the base; a proceeding, however, which

FIG. 1.

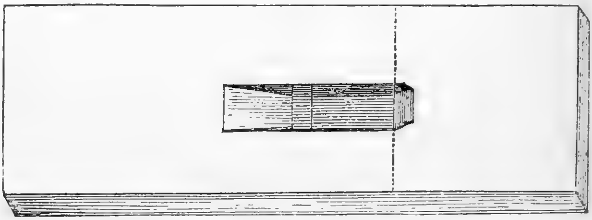
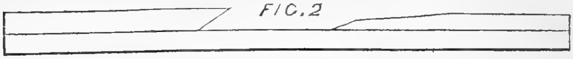


FIG. 2



does not appear much to incommode the animal. It will be as well to have several cells of the kind of different forms in readiness. At any rate, the deeper part of the hollow should be much shorter when it is intended for the Frog-tadpole than in the case of the Newt's, for which latter again the part for the reception of the tail should be somewhat shallower, or entirely omitted; and, on this account, the hinder wall of the excavation should be made very sloping or somewhat rounded, so that the flat tail may rest directly on the even surface of the slide. In the case of young fishes the hollow should be still narrower and shallower, and in this case it is advisable to bevel off the whole of the hinder border.

As the grinding out of a hollow of this kind in a thick piece of glass would be attended with difficulty, and consequently with considerable expense, I have always constructed the apparatus of three flat pieces of glass. The lower of these, as seen in fig. 2, is nothing more than a common slide, and upon this, as a basis, the two others, in which the requisite incisions have been made, are affixed by means of Canada balsam [or marine glue]. The dotted transverse line in fig. 1 shows the point of junction of these two pieces. When used the hollow is filled with water, into which the animal is introduced, with its head beneath the anterior border, and the tail in the shallow depression at the other end, or on the surface of the glass, as the case may be, the whole being covered with thin glass in the usual way.

Contributions *to the* Natural History *of the* Infusoria. By Dr. W. Zenker.

(Schultze's 'Arch. f. Mikrosk. Anatomie,' II, p. 332.)

(Abstract.)

1. *On the Pulsating Vesicle.*—The *pulsating*, or, as it is more usually though less characteristically termed, *contractile vesicle*, is one of those points in the anatomy of the Infusoria which has been the subject of the greatest controversy among zoologists. It is one of the most generally existing and most remarkable organs of the infusorian body, in most cases occurring singly, though in many two or more are found.* At a constant point in the body may be noticed a vesicle with clear reddish contents, which, with a rhythmical recurrence, first gradually enlarges, and then suddenly contracts, so as entirely to disappear. The rhythm of these usually very distinct pulsations may be rapid or slow. In some Infusoria, as, for instance, *Actinophrys Eichhornii*, it varies so that in that species it is frequently very tedious to await the contraction of the vesicle. On each occasion the contents of the vesicle which have been derived from the tissue of the body are expelled from it; and the question arises whether they are driven *inwardly*—that is to say, into the other parts of the animal—or *outwardly* into the surrounding water. In the former case it would be, as first asserted by Wiegmann in 1835, a *circulatory*, and in the latter an *excretory* organ.

To the advocates of the latter view Ehrenberg especially belongs, who was of opinion that the secretion might be seminal. This opinion, which was suggested perhaps by the enormous power of multiplication of the Infusoria, and was taken to be opposed to the doctrine of equivocal generation, should be regarded as long since exploded, and especially since it has been shown beyond doubt that the reproduction of the Infusoria is preceded by conjugation. Such a circumstance would be incomprehensible had impregnation been effected so conveniently at every moment, and from the earliest period of life. In favour of the same view, Oscar Schmidt ('Froriep n. Notigen,' 1849) adduced the first confirmatory observation in *Bursaria leucas* of the actual existence of an

* Amongst examples in which the number of vesicles is most numerous may be cited *Amphileptus anser*, Ehr., in which from ten to fifty pulsating vesicles are placed in two longitudinal series, extending from one end of the body to the other. The successive pulsations are alternate from before backwards.

opening directed outwards, and consequently of the evacuation of the contents of the vesicle into the surrounding water. His description is clear and distinct, and as convincing as the sight of the thing itself, which, with proper microscopical appliances, it must be confessed, is not difficult.

Nevertheless, since the appearance of the important works of Stein, Lieberkuhn, and of Claparède and Lackmann, the opposite view has obtained almost universal acceptance, Oscar Schmidt's observation having been regarded as based upon an optical delusion.

The controversy would appear to have been definitively settled by an observation of Claparède in a non-ciliated animal, *Actinophrys Eichhornii* ('Müll. Arch.,' 1854). This observation showed that simultaneously with the sudden collapse of the projecting vesicle no movement was perceptible in the minute particles suspended in the surrounding water; whence it was concluded that the contents must have been expelled, not in an outward but in an inward direction, and the pulsating vesicle was consequently proved to be a circulatory organ.

I am in a condition, however, to show that this generally accepted view is incorrect. It is said also that Lachmann, in the last days of his life, expressed himself in favour of my opinion.

In the first place, then, it is not true that the evacuation of the pulsating vesicle in an outward direction must necessarily produce any visible movement in surrounding suspended particles. It is quite correct to say that a movement would be produced were the contents of the vesicle compressed air, or were the expulsive force very great. But as the vesicle contains water, which is virtually incompressible, and upon which no great degree of pressure is exerted, the impulse which would be given by the expansion of the contained fluid on the contiguous parts is entirely wanting. An opening is suddenly formed in the delicate outer membrane in consequence of which the vesicle collapses, so that the contained fluid simply occupies the same space as before. The sole movements undergone by the water contained in the vesicle is due to its being forced through the more or less narrow orifice, in order to diffuse itself on all sides, and fill up the vacuum arising from the moderately slow collapse of the membrane. The motion of the fluid is consequently limited to the space previously occupied by the pulsating vesicle itself; and it is merely a sort of vortex, and always very feeble. Consequently it is only in extremely minute

and very closely contiguous particles that a trifling movement can possibly take place.

And this in accordance with what I have observed. In making the observation, it is necessary to choose for its subject, amongst those on the stage, an *Actinophrys* in which the pulsating vesicle is seen in profile, and at the same time turned slightly upwards. In this position the whole of the vesicle is sure to be visible, whilst when viewed exactly in profile, a considerable portion of it may, of course, frequently be overlapped. If the systole and diastole are now watched, it will be seen that immediately before the systole an opening is formed in the outer membrane, and always at the same spot, and *that during the collapse of the wall, the free borders of the opening quiver in an outward direction.*

From this observation, the correctness of which can hardly be impugned upon the ground of its resting upon "optical delusion," it is directly proved that the contents of the vesicle are expelled by the systole into the exterior water.

Assiduous observation will readily convince any one of the simple nature of the way in which the opening of the vesicle takes place. *The orifice,* that is to say, *is nothing more than a slit,* which is always reopened at the same spot, simply for the reason that the cicatrix, as it may be termed, of the previous rupture always remains the weakest part. After the collapse of the vesicle, a short period elapses before any indication whatever of it is again visible. As it must be assumed that the secretion of fluid into the vesicle is pretty nearly continuous, we must suppose that its outward flow is for a certain time unimpeded. The vesicle does not fill again until the fissure is entirely and firmly closed. If the site of the fissure be now brought accurately into focus, it will be clearly seen that the wall of the vesicle is at that spot very thin, but at some distance from it much thicker; and hs difference of thickness becomes more and more apparent as the vesicle continues to expand. But I have never been able to perceive any manifestly elastic extension, as in caoutchouc The observer at once feels that the vesicle will rupture at the thinnest part when the expansion has reached a further stage, as actually takes place, as above described.

In the true ciliated Infusoria a higher degree of organization is observable, although the process is essentially the same. Among this class, the species selected by Oscar Schmidt (*Bursaria leucas* and *Paramæcium Aurelia*) afford particularly favorable subjects for observation, owing to the circumstance that they may be held captive for a considerable

time by a thin covering class, without being destroyed. In them also it may be seen that a number (5—8) of serpentine canals radiate from the pulsating vesicle, the gradually finer and finer branches of which canals may be traced over both sides of the surface of the body. These canals were regarded by Wiegmann, and afterwards by Von Siebold, as the conduits of an *oscillating*, blood-circulation, because they observed them to become distended with fluid immediately after the systole of the vesicle itself. And this phenomenon, it must be confessed, very readily led to the impression that the movement of the fluid was *from* the vesicle towards the canals.

Nevertheless, if a *Bursaria leucas* be laid upon its side, in such a position that the pulsating vesicle is viewed at its greatest distance from the axis of the body, it will be plainly seen to lie immediately beneath the outer membrane, and that at each systole it contracts in an outward direction. And the same condition, with fewer exceptions, as, for instance, in the Vorticellæ, obtains in all other Infusoria. But in no case can the contained fluid be seen to retire towards the interior of the body; we are compelled, therefore, to assume the existence of an external orifice.

This orifice becomes visible when the animal is so turned that the vesicle appears to lie in the axis of the body, and consequently when it is in a position to be looked into either from the outer or the inner aspect. Under these circumstances, there will be seen in the centre of the spherical vesicle a smaller circle, with sharply defined borders, which are best seen in oblique illumination, the circlet itself presenting a bluish-grey colour. Thus it remains during the whole diastole; at the moment of the completion of which its colour suddenly changes into the same palish-red hue as the rest of the vesicle; and from this moment the vesicle collapses.

The orifice consequently in this case is constantly existent: but by careful adjustment of the microscope an extremely delicate viscous substance will be perceived by which the orifice during the diastole is covered, and, as it were, plastered over. *I have often witnessed the rupture of this substance commencing on each side, before the collapse of the vesicle, and the assumption of the red colour by the orifice.*

The presence of this cement renders the simple nature of the proceeding perfectly clear, During the diastole the flow of fluid brought by the vessels compresses the surrounding substance uniformly in every direction. The further the

substance is compelled to retreat, the more is the membrane, formed by the viscous cement which is adherent to it, stretched until suddenly it gives way and is torn across from side to side. At the same time the parts resume their former position; that is to say, the sides of the vesicle come together and remain invisible as long as it is open, that is, until the cemented material has again blocked up the orifice. The closure of the vesicle causes that of the adducent vessels, because the surrounding substance at the periphery, even of a still enlarged vesicle when forced to accommodate itself to that of a contracted one, must be compressed, and consequently must lose all vacuities. The consequence of this is that the vessels in their turn become distended by the fluid which is poured uninterruptedly into them from their capillary ramifications. In any case they are obstructed, as is obvious from the violence and want of absolute simultaneousness observable in their outflow when it takes place.

The change of colour above noticed indicates simply the presence or absence of the occluding mucus over the orifice. The pulsation may be altogether prevented by keeping the animal a little while in only a thin film of water beneath the covering glass, whose pressure at length puts a stop to all movement. Under these circumstances the vesicle remains about two thirds to three quarters full, the radiating vessels also remain constantly open, as well as does the external orifice. Consequently in such a case there is no possibility of the existence of an oscillatory circulation, but, on the contrary, of a continuous uniform excretion.

Thus, in both instances, we find that the closure of the vesicle is effected by a cementing substance which replaces, as it were, the sphincter muscles, by which a similar function is fulfilled in more highly organized animals. One would be tempted to regard this material as of an analogous nature in both cases, that is, an amorphous protoplasm, to adopt an expression of Max Schultze's, and which is certainly correctly applied in the case of *Actinophrys*. In the ciliated infusoria however, it appears to me more correct to regard the substance in question as a true product of secretion, since, particularly with the great *Spirostomum ambiguum*, it is easily seen how frequently mucoid excretions from the substance of the body are collected in the very large pulsating vesicle, and how these are again expelled from it. After seeing this animal it is incredible that the existence of an external orifice should have been so long a matter of doubt.

The existence of an external orifice to the vesicle, and the circumstance that its contents are entirely evacuated out-

wardly, at once upsets the theory that its function is that of a circulatory organ or heart. But the question then arises, What is the nature of the fluid which is thus continually got rid of? It is perfectly transparent, and appears of a very pale reddish colour. The last circumstance may probably have been one reason why zoologists have regarded the fluid as spermatic or as blood. So far as I know, Oscar Schmidt was the first to observe that the water close to the infusorium was also of a reddish hue, owing to the contrast with the bluish colour of the animalcule. There appears to be no reason, therefore, to suppose that the fluid is anything more than plain water; no doubt with respect to this can be entertained when we consider the enormous quantity in which it is excreted. It is possible, however, that it may occasionally contain minute quantities of albuminous compounds (as in the instance of *Spirostomum ambiguum* just cited).

Water alone could be excreted in such large quantities without injury to the organism. The infusoria are capable of continually taking in large quantities of water spontaneously by the mouth; and the cavity of the body is also entirely filled with it. In like manner they are surrounded with water on all sides, which may possibly find admittance through the skin, even leaving out of question the canals. In any case it is important to arrive at a clear notion of the various possibilities of the case, since in this phenomenon we are concerned with the most active change of matter that takes place in the body of the infusoria.

In the rhizopoda, many of which are likewise furnished with a pulsating vesicle, there can be no doubt that the external surface, or some part of it, must be the site of imbibition, since these creatures have no mouth. And a similar instance is afforded by the *Opalina*, astomatous infusoria which occur so abundantly in the rectum of the frog, and which are furnished with whole series of pulsating vesicles. On the other hand it may perhaps be assumed that where the outer membrane is of a harder consistence it is rendered unfit for the function of absorption. Such would be the case, for instance, in the mantle of the *Vorticellæ* and *Acinetæ*, in which instance it would appear pretty certain that the water finds entrance only through the mouth or some analogous organ.

It is at any rate evident, from the wide distribution and fine ramification of the radiating vessels in *Bursaria leucas*, that the water is collected from every part of the walls of the body, and consequently that it pervades the entire body of the animal, which, to express it in a few words, consists merely of an envelope surrounding the large cavity into which

water is constantly entering in active currents. Although this distribution of the vessels is apparent, only a few Infusoria with the equal distinctness (*Paramecium aurelia, Nassula elegans*), nevertheless indications of the existence of similar capillary vessels are manifest in other instances (*Spirostomum ambiguum*); and this leads to the supposition that the same disposition exists in other ciliated Infusoria.

All that has been above adduced with respect to this process leads to the conclusion that it is of a respiratory nature, as suggested by Spallanzani and Dujardin ('Hist. des Inf.,' p. 109). Whether the water be introduced through the mouth or integument, it is impossible that it should pervade the body of the animal through such a fine capillary network without it leaving something behind which, from analogy, can only be the oxygen contained with water. Thus we have a respiratory apparatus which may be compared with the branchiæ of fish or other animals. In every apparatus of this kind especial provision must be made for the expulsion of the water which has been used, and this object is answered by the contractile vesicle. But a difference exists between this kind of respiration and that which is effected by branchiæ, in the circumstance that, in the latter case, the current of water is introduced by mechanical means, and remains on the surface, the oxygen only penetrating into the interior; whilst in the case of the Infusoria the whole of the water enters, and *pervades* the substance of the body *throughout*. It may also be said that there is no visible mechanical appliance, unless it be assumed that the current set in motion by the oval cilia is sufficiently powerful to carry the water through the tissues of the body, and that afterwards expelled by the pulsating vesicle. In such instances as *Actinophry*, more especially, this theory would leave us completely in the lurch; consequently the propulsive force must be simply of a chemical nature, and in order to illustrate the notion I entertain of the process I would propose the following hypothesis:—"That the oxygenated water is more powerfully attracted by the tissues than when it is deprived of its oxygen." This being admitted, the reason why the de-oxygenated water is always impelled by the oxygenated; and why one is always taken in, and the other expelled is at once apparent.

I am reluctant to propose such an hypothesis without having subjected its correctness to the proof of experiment; but this I have hitherto found it impossible to carry out. In order to establish it, it would be necessary to institute similar conditions experimentally. This might be done, for instance, if a cylinder of carbon were filled with pure water and placed

in water containing sulphuric acid. It might then be presumed that so long as the acidulated water was absorbed the pure water would be pushed forwards until the absorptive power of the carbon was exhausted.

And here I cannot conclude without noticing the remarkable action exerted by the water upon the substance of the body, when deprived of protection by the removal of the external membrane. The projecting particles visibly become more or less swollen, until suddenly the entire substance bursts asunder, in consequence of which the detached particles are widely dispersed. The subjacent particles, being thus exposed to the action of the water, are in a similar manner disintegrated and dispersed, and so on until the whole animal is dissolved. Thus we must suppose that in this case also water is continuously absorbed from without, and excreted towards the interior; but the normal channel for this no longer exists, owing to which the elementary particles of the substance of the tissue are at first distended as far as their elasticity will allow. When this limit is passed they burst asunder, whilst their now unfettered elastic force expels the water they contained, by which they are themselves dissipated, and all the above described phenomena follow. The *nucleus* retains its form longer than the other parts of the organism, but is also finally disintegrated. Thus respiration may be said to exist even in this case, though to a less extent, in which respect it corresponds with what may be observed in the embryonic stage, as in the *Acinetæ*, for instance, in which the pulsating vesicle has a much slower rhythm than in the parent animal.

QUARTERLY CHRONICLE OF MICROSCOPICAL SCIENCE.

GERMANY.—**Zeitschrift f. Wissensch. Zoologie.** —Vol. xvii, Part III. July, 1867.

1. "*On the Development of the Tissue of the Membranous Cochlea,*" by Dr. C. Hasse, of Gottingen.

2. "*Supplementary Remarks on the Anatomy of the Cochlea in Birds,*" by the same.

The former of these communications gives the results of an investigation into the development of the tissues of the *Membranous Cochlea,* undertaken with the view of completing and establishing those which had been arrived at by the author in two previous memoirs, one entitled "*De Cochleâ Avium,*" and the other, which has appeared in the present volume of the 'Zeitschrift' (p. 56), "*Die Schnecke der Vögel.*" Dr. Hasse also considers that his researches may give a further stimulus to the study of a subject which, in his opinion, affords the prospect of an abundant harvest of discovery.

His inquiry has been confined entirely to the development of the *Cochlea* in the chick, but he considers that the results will be found equally applicable to the same part in man and other animals.

The researches were made in sections, partly of the isolated membranous *Cochlea,* and partly of the same part remaining in its chamber or case. In order to isolate the *Cochlea,* the brain is to be removed and the inner wall of the cranium exposed, when the situation of the *Cochlea* will be readily recognised by its shining appearance through the walls. The surrounding tissues being then carefully torn away under the microscope, by means of a fine knife or needles, the *Cochlea* is easily detached. It is then placed in strong alcohol till hardened and thin transverse sections of it can be made.

Details are given respecting the development of—(1) the Cartilage; (2) the *Tegmentum*; (3) the *Membrana basilaris,* upon which the author lays great stress; (4) of the nervous elements. Parts whose development still requires further investigation are—(1) The Tigmental cells; (2) those of the triangular cartilage; (3) of the denticulate cells; (4) of the *Papilla spiralis.*

The second paper is chiefly devoted to an account of the minute structure of the Cochlear ganglion and the terminal filaments of the Acoustic nerve.

3. "*On some Tropical Larval Forms,*" by Dr. C. Semper, of Wurzburg.—Shortly before the Author's departure for the Philippine Islands in the year 1858, his attention was directed by Prof. Behn, of Kiel, to a minute marine animal which that observer had met with in his voyage round the world in very various regions of the tropical seas. This was a cylindrical creature about 6mm long, and characterised by a longitudinal tract of cilia running from one end to the other.

Dr. Semper noticed this apparently larval form for the first time somewhere about 42° S.L. near the Cape, as the ship was passing through a broad shoal as it were, of the most various kinds of oceanic creatures, brought by the warm Mozambique current flowing out of the Indian Ocean. The next occasion upon which he fell in with it was in the Straits of Sunda and on the South Coast of Java.

The body presents the form of a cylindrical sac open at each end, and having thick walls whose colour gives the creature a beautiful striped or banded aspect. The oral opening, which is always in front when the animal swims, leads into a short sort of infundibuliform pharynx, from the lower end of which six wide mesenteric bands proceed through the ciliated abdominal cavity to the posterior end of the body. The anal orifice is of the same size as the oral. The integument contains very numerous nematocysts of two kinds, one of an elongated oval form, and the other of slender clavate shape. The ciliated band, consisting of closely approximated cirrhi, can be reclined to either side, but in the active state stands erect. It is situated along the middle of a yellowish-brown flattened elevation of corresponding length.

From the above particulars the author concluded, without doubt, that the creature must be the larva of an *Actinia.*

But at the same time he met with another smaller larva, which, instead of a ciliated longitudinal band, was furnished with a circlet of cilia like that of an Annelid larva. He made no notes respecting the conformation of its stomach or ventral

cavity. In its integument, however, were situated numerous thread-capsules which, in form and size, as well as in the structure of the extruded urticating thread, corresponded with those of the above-described creature.

The author is inclined to believe, though by no means regarding it proved, that the larva with the longitudinal band of cilia, may represent only a further stage of development of that with the ciliated circlet, chiefly from the circumstance that the urticating capsules are alike, organs that have never yet been observed in any true Annelid larva.

With respect to the presence of thread cells, he remarks that until within a brief period no one would for a moment have doubted that both these forms belonged to the Cælenterata, which alone were supposed to be furnished with those organs. There can, however, now be no doubt, from extensive observations both in terrestrial and aquatic forms, that in the Æolidina, Diphyllidia, certain Cephalopoda among the mollusca, in the *Planaria* among Annulosa, animals are found which also possess urticating capsules, sometimes in the integument, sometimes in special glandular *sacculi*. And more recently, Keferstein has even described a Sipunculidan furnished with them.

The description of these larval forms is followed by a long and interesting disquisition as to the value of the various classifications of the lower animals, as regards more especially the Cælenterata and the various forms assembled by Cuvier under the Radiata or Zoophyta, with which, as is well known, together with the distinct group of the Echinodermata, he included also the Sponges, Bryozoa, and the forms now placed in the Cœlenterata.

4. "*On Solenogorgia tubulosa*," n. gen., by Carl Genth.—In the 'Annals and Magazine of Natural History,' 3rd ser., vol. x, Dr. Gray notices two new species of Alcyonariæ, to one of which that observer has given the name of *Solenocaulon tortuosum*. The author is in some doubt whether the form he describes may not be identical with this species; but since Dr. Gray does not enter into any particulars regarding its minute structure, by which alone the question could be fully determined, Herr Genth considers it better to regard his as a distinct genus, to which he has given the above name. His specimens were brought by Dr. Semper from the Philippine Islands.

The growth consists of a main stem, which divides into irregular dichotomous branches. Both stem and branches are hollow, and at the points where the main branches spring

from the trunk are openings leading into this internal canal, which constitutes, as it were, a continuous canal-system. The canals open in spoon-shaped slits at the extremities of the branches. The canal seems to be formed by the union of the borders of an originally simple flattened lamella or riband.

The polype-cells are circular, and are placed in rows, which are so disposed that the middle line of each branch is left free. The cells are often closely crowded in these rows, especially at the upper part of the stem and at the ends of the branches.

The species is thus characterised:—Stem somewhat flattened, slightly flexible, solid, pervaded by nutritive canals. Branches and ramules furnished with lateral flat appendices, which, except at their commencement and end, are so grown together that the branches and ramules appear to be hollow. Polypes disposed in two series, which leave the underside and middle line of the branches and ramules above, free. Each polype is seated in a more or less well-defined eight-rayed disc or cup. The interior of the entire cœnœcium, pervaded by nutritive canals, with the exception of an ill-defined slender axis which is found in the branches. The spicula, except in this axis, free. An imperfectly developed horny substance occurs in places in the central parts of the whole cœnœcium.

The systematic position of this new and curious genus, he says, is obviously among the Gorgonidæ, and in the family of the Briareaceæ of M. M. Edwards.

5. "*On the Ganglion-cells of the Spinal Chord,*" by Friedrich Jolly.—The author's observations were prompted principally with a view of examining the results arrived at by Fromman,* and by Deiters.† And they were instituted chiefly on the cells of the anterior *cornua* of the chord; which on account of their greater size afford the best characters for observation.

"It is of the greatest importance," he observes, "in an inquiry of this nature, to examine the chords of various animals besides man, inasmuch as the cells even from corresponding parts differ enormously. As regards the human subject the chord of the newly born infant is to be preferred." Here follows the mode of preparation recommended by Deiters (l. c. p. 1—26). The author considers that sections of hardened preparations are almost inapplicable for the study of the ganglion cells, owing to the changes produced in those

* Virch. 'Arch.,' Bd. xxxi, Heft 2, and Bd. xxxii, Heft 2.

† 'Unters. üb. Gehirn und Rückenmark des Menschen und der Säugethiere. Braunschweig, 1865.

delicate bodies by the chemical reagents employed. The cells should be as much as possible isolated, and this can be done by judicious maceration in weak solutions of chromic acid $\frac{1}{30}$, $\frac{1}{20}$, $\frac{1}{10}$ grain to the ounce of water, or of $\frac{1}{2}$, 1, 2 grains of chromate of potass.

Acknowledging the perfect correctness of Dr. Beale's and of Deiters's figures and descriptions of the fibrillated appearance of the ganglion cells, he observes that this appearance, which Dr. Beale ascribes to the existence of peculiar currents pervading the cell during life, and which is described by Frommann as indicating the composition of the cell to be mainly of a plexus of fibrils proceeding from the nucleus and nucleolus, the author regards as altogether artificial, and to be due in part to corrugation and in part to coagulation of the cell substance.

6. "*On the male of Psyche helix* (*Helicinella*) *together with Remarks on the Parthenogenesis of the Psychidæ*," by Prof. C. Claus, of Marburg.—The object of this paper, which contains a very compendious history and literature of the subject of parthenogenesis in the Tineidæ and Bombycidæ, is to prove that the male of *Psyche helix* does really exist, and to give a description of it, which is illustrated by beautiful figures. The author consequently concludes that even in that species,—in which, as is well known, parthenogenesis was supposed, more than in any other, to be the only mode of reproduction,—the concurrence of the sexes, at any rate occasionally, intervenes.

7. "*On the Formation, Structure, and Systematic Value of the Egg-shell in Birds*," by Dr. R. ,Blasius.—This memoir was prepared in accordance with a wish expressed by the author's father, that Landois' 'Histological Researches on the Eggs of various species of Birds' might be extended to other species, with the view of ascertaining the systematic or classificatory value afforded in the minute structure of the shell.

In proceeding with this task, the author commences with the minute structure of the different parts of the *oviduct*, which is preceded by a copious historical and critical account of previous writings on the subject. He then gives an account of the histology and development of the egg-shell in the fowl and pigeon, concluding with the systematic value of the results.

With respect to the third subject, or to the value of the systematic characters derivable from the microscopic investigation of the shell,—to which, as is well known, M. Landois attached very great importance,—Dr. R. Blasius remarks that

in order to judge of this value, three preliminary questions must be answered:

1. Whether the structure of the shell in the same egg is uniform throughout.

2. Whether the histological composition of the shell is constant in one and the same species. And

3. Whether constant differences can be discerned between nearly allied species.

The general conclusions at which he arrives, after extended researches, which are admirably detailed in the paper before us, seem to be that the intimate structure of the egg-shell possesses scarcely any greater systematic value than do the external macroscopic characters; and consequently, that oology, even with this addition, stands just where it did, as regards systematic ornithology.

8. "*Observations on a former Communication by Landois,*" (Zeitsch. f. w. Zool. Bd. xvii, pp. 375), by Professor V. Siebold.—These observations, by Professor V. Siebold, have reference to M. Landois' assertion that in the eggs of insects—or, rather, it should be said, in the embryo—of insects, while still within the egg, there are no distinct indications of the future sex, which, according to him, is determined after the escape of the embryo from the egg, by differences in the food with which it is nourished. This extraordinary statement is apparently supported by experiments which M. Landois made with bees, and consisting in the removal of the egg which had been laid in a "drone-cell" into the cell of a "worker," and *vice versâ*, in consequence of which he states that the sexes were developed also, apparently in accordance with the change of locality, and, as he supposes, of food; being apparently ignorant of the fact that up to the sixth day, at least, of the life of the maggot, before which time the sexual organisation is manifest, both workers and drones are fed upon the same food. Professor V. Siebold expresses considerable doubts as to the correctness of the results arrived at in these experiments, and adduces numerous instances in other insects which tend to show that M. Landois' hypothesis strongly requires further evidence in support of it before so strange an anomaly can be admitted into science.

And in this view, V. Siebold is briefly followed in the next article.

9. "*On the Law of Development of the Sexes in Insects,*" by Dr. Kleine, whose observations, however, are limited to the question of sex in bees only; with regard to which insects he considers that M. Landois is but imperfectly informed, whatever value may attach to his observations in other parts of Entomology.

Archiv fur Microskop. Anatomie (Max Schultze's). Part III. 1867.

1. "*On the Genesis of the Spermatozoa,*" by Von la Valette St. George.—This is the second part of a memoir by a very careful microscopist—the first part of which appeared in the first number of the 'Archiv' (1865), together with one on the same subject, by F. Schweigger-Seidel, of which we gave a brief notice at the time. In this paper the author discusses the views of Schweigger-Seidel and Kölliker, and gives figures of the development of the spermatozoon of man, the dog, the mouse, the guinea-pig, the rabbit, the green-water frog, the speckled salamander, the earwig, the house-cricket, and two gasteropods.

2. "*On the Structure and Development of the Labyrinthulæ,*" by Professor L. Cienkowski.—The organism to which the author has applied the name *Labyrinthula,* was found by him at Odessa beneath the marine algæ which encrust the piles of the harbour of that town. It presented resemblances to the Fadenplasmodium described by him in 'Pringsheim's Jahrbuch,' vol. iii, p. 408; but he has made a careful study of it, and considers it the type of a new group of organisms. Three plates, one of which is coloured, illustrate this paper. The Labyrinthulæ are minute, orange-coloured bodies, forming reticulated threads which enclose spindel-shaped bodies. Cienkowski sums up their peculiarities of structure and development thus:

(1) They present masses of cells which enclose a nucleus, and which increase in number by division, and possess a certain degree of contractility, and which now and then are covered with a cortical substance.

(2) These cells exude a fibrous substance, which forms a stiff and tree-like network, forming a branching frame-work.

(3) The cells leave the mass and glide in different directions along the framework to the periphery of the mass. The Labyrinthula cells can only continue their peregrinations when supported by this line of threads.

(4) The moving cells unite in a new mass and become cysts, in which each cell is surrounded by a hard covering, the whole being held together by a rind-like substance.

(5) After some time four small granules are formed from each cyst, which most likely become young Labyrinthula cells.

The author says he would leave the further examination of the development of Labyrinthula to future researches. For the first step this must be sufficient to show that these peculiar organisms bear no relation to any known group of beings

of either of the organic kingdoms. They cannot be classed with the sponges Rhizopoda, Grengarinæ, or ciliated Infusoria, or with the Algæ and Fungi. There is nothing even by which we can find a connection between the Labyrinthulæ and the Algæ, or other allied Flagellata; for the framework of Labyrinthula, as its development shows, is to be considered as an exudation of cells—as a peculiar fibrous, jelly-like formation. Supported by this we are led to the Palmellacæ, Conjugatæ, and Flagellatæ, where we can see such formations, but where the giving out of the jelly-like substance is confined to certain portions of the surface of the cells, whereby single or star-like points are formed, to which the separated cells remain sticking. We find numerous examples of this in the Anthophysa, Doxococus, Colacium, and the like. These complex organisms, the production of the separation of many cells, could be compared with the network of Labyrinthulæ, although the cells in this case remain fixed, and never move on the framework.

It would be possible to compare the Labyrinthulæ to some kinds of compound diatoms which are covered with a gelatinous substance: for example, *Bacillaria paradoxa;* but then the cells of the diatom, and the fusiform bodies of the Labyrinthula differ so widely in structure and development, that no comparison is admissible.

3. "*On* Clathrulina, *a new Actinophrys genus.*" by Prof. L. Cienkowski.—This is a very beautiful stalked form. Its development and structure are described and illustrated in a neatly drawn plate.

4. "*On the Origin and Development* of Bacterium termo *Duj,*" by Joh. Lüders, of Kiel.

5. "*Remarks on the preceding Paper,*" by Professor Dr. Hensen, of Kiel.

The first of these communications is, it appears, by a lady. She has before this, in Von Mohl's 'Botanische Zeitung,' 1866, p. 33, endeavoured to show that certain Fungi and the Vibriones have a most intimate relationship. This opinion has been strongly opposed by Professor Hallier in a paper published in the 'Archiv' (1866), p. 67, which we noticed in this Chronicle.

Frau Lüders in this paper endeavours to show that many vibrio-forms may be produced by growing various moulds. She gives figures of vibrio-forms from *Botrytis acinorum,* grown in flesh-water, from *Mucor mucedo* grown in pure spring-water, from *Penicillium glaucum,* grown in pure water and other liquids. The history of the *Vibriones, Bacteria,* and the various forms of the lower fungi, varying, as they do,

according to the "nidus" in which they are developed, is a highly important field of research. Professor Hallier's work, 'Die Pflanzlichen Parasiten des menschlichen Korpers,' published at Leipzig in 1866, is one of the latest on the subject. In English we have nothing written which is well up to the time. The study of these forms by cultivating them under the field of the microscope is of great importance, bearing so largely as it does on the possible variations of species and their origin.

6. "*A Contribution to the Knowledge of Miescher's Sacculi,*" by Professor W. Manz, of Frieburg.

7. "*On the Structure of the Connective Tissue of the Eyelid,*" by Dr. Ludwig Stieda, Professor in Dorpat, illustrated with half a plate.

8. "*A Gas Chamber for Microscopical Purposes,*" by Dr. S. Stricker.—The author feeling the great importance of such researches as those of Recklinghausen on the action of carbonic acid on blood, and of Kühne on the action of gases on the cilia of the ova of Anodontæ (Max Schultze's Archiv, Bd. II, p. 137, and p. 373), has devised a small instrument to place on the stage of the microscope, by means of which a small object may conveniently and efficiently be subjected to the action of a gas. A woodcut of the instrument is given—which may be more fully described hereafter.

9. "*Remarks on the Structure and Development of the Retina,*" by Max Schultze.

10. "*On the Action of Quinine on Protoplasmic Movements,*" by Dr. C. Binz.—Inquiries of this nature are of very great importance, and tend directly towards the explanation of vital phenomena. More of this kind of work might be done by English microscopists. Dr. Binz has studied the action of quinine on the movements of *Vorticella campanula, Actinophrys Eichornii,* and *Amœba diffluens,* of the white blood-corpuscle, and of the currents in *Tradescantia virginica.* He has also made some experiments with morphia and strychnine. The writings of Max Schultze and of Kühne on Protoplasm are referred to and discussed.

11. "*Spongological Note,*" by Oscar Schmidt.

12. "*A Reclamation, touching the formed Sarcode ('geformte Sarcode'),*" by Oscar Schmidt.

13. "*On* Actinophrys Eichornii, *and on a new fresh-water Rhizopod,*" by Dr. Richard Greef.

14. "*On the Terminal Organs of the Optic Nerves in the Eyes of Annulosa,*" by Max Schultze.—This is a brief note discussing the conclusions of Leydig in his beautiful illustrations of the nervous system of Annulosa lately published.

ENGLAND.—Space compels us to curtail the chronicle very greatly this quarter. We shall notice the French and English journals in January, as also some papers read at Dundee, in addition to the one here abstracted.

British Association.—"*The Anatomy of the Thysanura,*" by Sir John Lubbock, F.R.S. He remarked that the Thysanura, though extremely numerous, and in many cases very pretty litle creatures, had attracted but little attention, owing, perhaps, to their great delicacy and the consequent difficulty of preserving them in a satisfactory condition. Under any decaying log of wood, under damp leaves, in long grass—in short, in almost any damp situation, the Thysanura form no small proportion of the population. Like other insects, they have six legs, but they never acquire wings. The tail is provided with two long appendages which are bent forward under the body, and thus form a spring, by means of which the animal is enabled to jump with great activity. A Smynthurus, for instance, measuring one tenth of an inch in diameter, will easily jump up twelve inches in the air. This, however, is due mainly, not to muscular power, but to the elasticity of the spring. The muscles draw the spring forward and bring it under a small latch or catch. Directly this is relaxed the elasticity of the body jerks the spring back, and throws the creature upwards and forwards. The author described in detail the muscles by which the spring is moved. Another remarkable peculiarity in the Thysanura is the presence, on the first abdominal ring, of a process which acts as a sucker in the Poduridæ, and in Smynthurus gives rise to two long filaments which serve the same purpose. The author described the arrangement of the muscles by which this curious apparatus is moved. He then described the digestive and respiratory organs, and pointed out that Smynthurus and Papirius, though very nearly allied in external character, differ entirely in their method of respiration, the latter genus being almost or entirely deficient in tracheæ.

NOTES AND CORRESPONDENCE.

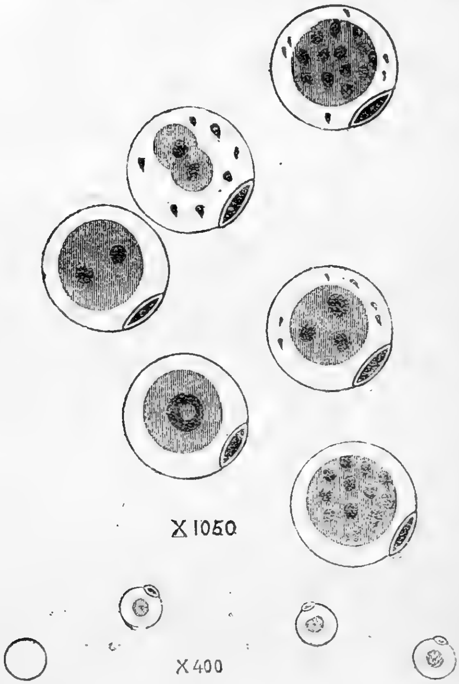
Experiments on the Poison of the Cobra-di-Capella.—The melancholy accident which so lately happened with the cobra-di-capella induced me to make some experiments and observations upon the action of the reptile's poison, and they have proved so eminently interesting that I am induced to send you an epitome of them.

I have to state, then, that when a person is mortally bitten by the cobra-di-capella, molecules of living "germinal" matter are thrown into the blood, and speedily grow into cells, and as rapidly multiply, so that in a few hours millions upon millions are produced at the expense, as far as I can at present see, of the oxygen absorbed into the blood during inspiration; hence the gradual increase and ultimate extinction of combustion and chemical change in every other part of the body, followed by coldness, sleepiness, insensibility, slow breathing, and death.

The cells which thus render in so short a time the blood unfit to support life, are circular, with a diameter on the average $\frac{1}{1700}$ of an inch. They contain a nearly round nucleus of $\frac{1}{2800}$ of an inch in breadth, which, when further magnified, is seen to contain other still more minute spherules of living "germinal" matter. In addition to this, the application of magenta reveals a minute coloured spot at some part of the circumference of the cell. This, besides its size, distinguishes it from the white, pus, or lymph corpuscle.

Thus, then, it would seem that, as the vegetable cell requires for its growth inorganic food and the liberation of oxygen, so the animal cell requires for its growth organic food and the absorption of oxygen. Its food is present in the blood, and it meets the oxygen in the lungs; thus, the whole blood becomes disorganized, and nothing is found after death but dark fluid blood, the fluidity indicating its loss of fibrine, the dark colour its want of oxygen, which it readily absorbs on exposure after death.

Let it not be thought that microscopic particles are unable to produce such great and rapid changes. It is well known,



and I have frequently timed it with my class, that a teaspoonful of human saliva will, when shaken with a like quantity of decoction of starch, convert the whole of the latter into sugar in a little less than one minute. If ptyaline, the active principle of saliva, exerts this power at most in a few minutes, then surely the active principle of the secretion of the serpent's poison-gland may exert an infinitely greater power in as many hours.

It results, then, that a person dies slowly asphyxiated by deprivation of oxygen, in whatever other way the poison may also act, and so far as the ordinary examination of the blood goes, the post-mortem appearances are similar to those seen after drowning and suffocation.

I have many reasons for believing that the *materies morbi* of cholera is a nearly allied animal poison. If so, may we not hope to know something definite of the poisons of hydrophobia, smallpox, scarlet fever, and, indeed, of all zymotic diseases?

I will not take up your space further, as I intend to discuss the whole subject, which abounds with matter of the deepest importance to physiology and medicine, as critically as possible in my lectures at the University, which recommence next week, when I hope also to show the presence of the poison of our Australian snakes in the blood of bitten and inoculated animals, and to make some experiments on the possibility of saving life.—GEORGE B. HALFORD, Australia.

On the Action of Monads in producing Colouring Matter.—Will you allow me to make a few remarks on Mr. Sheppard's paper on the action of monads in producing a colouring matter? It appears to me that a mystery has been here conjured up quite unnecessarily, and that, in searching for a hidden cause to explain the phenomenon of his coloured liquid, Mr. Sheppard has overlooked the simple and obvious one. The pool whence Mr. Sheppard obtained his colour-producing matter was, he states, formed by a clear spring, rising in a rocky basin; and the olive-brown growth which he collected was "just such a coating as promised *Oscillatoriæ*." He also says, he observed with the microscope a filament of *Batrachospermum* (p. 69). Now, it is a well-known fact, that the Oscillariæ and their allied forms contain very remarkable colouring matters when alive, and without any artificial addition of albuminous matters. These colouring matters are soluble in water, and when the plants or parts of them die (as they were made to do by Mr. Sheppard's treatment), the water in which they are placed becomes stained with the colour. I have not the slightest doubt that Mr. Sheppard's mysterious fluid is a solution of one of these colouring matters. The colouring matters of the lower algæ have been studied by both Kutzing and Nägeli, but most recently by Cohn, an abstract of whose researches appears in your last issue (p. 209 of the Journal). The Rev. J. B. Reade (p. 68 of the Transactions), in a letter quoted by Mr. Sheppard, says that he learnt from Mr. Sorby, "that a German naturalist had just lately discovered a *monochromatic* solution, 'the result of decaying algæ;'" and Mr. Sheppard gives reasons for supposing that his and the German's colour are not the same. The fact, however, is, that Mr. Sorby referred to Cohn's paper, to which I had drawn his attention; and Mr. Reade must altogether have misunderstood what was said. Cohn describes two colouring matters, both of which are *fluorescent*, and therefore, in a certain

sense, dichroic; and neither of these are "the result of *decaying*," but are contained by *living* algæ. Mr. Sorby agrees with me (in a letter received a few days since) that Mr. Sheppard's colouring matter is identical with that which Cohn calls "phycocyan," and which is found in plants allied to *Batrachospermum*. It is hardly necessary for me here to quote the account of this substance given in your last Quarterly Chronicle. It agrees with Mr. Sheppard's substance, in forming a pale blue solution in water (with a strong carmine fluorescence), from which it frequently precipitates as a jelly. Dr. Cohn gives a drawing of the spectrum of Phycocyan, which I have compared with Mr. Browning's drawing, and I have found them to agree, though Cohn has used a prism of greater dispersive power than that made by Mr. Browning. There can be no doubt in the mind of an unprejudiced observer that this is the history of Mr. Sheppard's coloured solution, which does away with its mystery without lessening its real interest. I may just say that the red colour of Protococcus, &c., is a very different body, being a scarlet monochromatic oil known as hæmatochrome.—E. RAY LANKESTER, Christ Church, Oxford.

Corethra plumicornis.—In the brief summary ('Transactions,' p. 99) of the principal points of interest appertaining to the structure of this transparent creature, the author has not deemed it advisable to complicate the narrative by references to the labours of other observers. Any one, however, who may wish to prosecute the study of its anatomy will find that the microscope has not been idle in recording the wonders of its organization. In the 'Popular Science Review' for October, 1865, Mr. Edwin Ray Lankester published an excellent paper on the subject, while on the Continent Leydig, of Tubingen, has written largely on the nervous system and on the structure of the heart ("Anatomisches und Histologisches über die Larve von *Corethra plumicornis*," in Siebold and Kölliker's 'Zeitschrift,' B. 3, S. 435). A monograph by Karsch, 'De *Corethra plumicornis* metamorphosi,' may likewise be advantageously consulted. But the most elaborate account of its anatomy and general history is given in an admirable paper by Dr. August Weismann, "Die Metamorphose der *Corethra plumicornis*," in Siebold and Kölliker's 'Zeitschrift' for October, 1866, Bd. 16, S. 45.

PROCEEDINGS OF SOCIETIES.

Royal Microscopical Society.

King's College, June 12th, 1867.

At this, the last monthly meeting prior to the recess, the chair was taken by Dr. Arthur Farre, F.R.S., V.P.R.M.S., in the absence of the President, James Glaisher, F.R.S.

The chairman congratulated the meeting upon the fact of there being on the list of candidates for election, as Fellows of the Society, the names of fifteen gentlemen to be balloted for, besides several others whose names were announced for suspension; and on the passing of the usual vote of thanks to Major Owen, F.L.S., for a series of slides presented to the Society, he referred to a suggestion he had made several years previously to the effect that each Fellow of the Society should make a rule to present to it at least six slides once a year. Mr. Browning, F.R.A.S., exhibited an enlarged spectrum of the dichroic fluid shown by the Rev. J. B. Reade, M.A., F.R.S., at the last meeting of the Society, upon which a discussion ensued, in which Mr. Browning, Mr. Hogg, the Rev. J. B. Reade, and others, took part.

A paper was read "On Nachet's Stereo-pseudoscopic Microscope," and "On the Angle of Aperture best suited for Stereoscopic Effects," by Dr. Carpenter.

Dr. Carpenter also described a Dissecting Microscope by Nachet.

A unanimous vote of thanks was passed to Dr. Carpenter for his communications; and Mr. Wenham, Mr. Gray, and Mr. Slack made a few observations upon various points, to which the author replied.

Professor T. Rymer Jones gave a very interesting description of the larva of *Corethra plumicornis*, and exhibited a series of coloured drawings to illustrate its structure. A unanimous vote of thanks was passed to Prof. Rymer Jones for his communication.

A paper was read "On a Parasite found in the nerves of the Haddock," by Dr. Maddox, communicated by G. Busk, Esq., F.R.S.

The following gentlemen were duly elected Fellows of the Society:—Sir Thomas Beauchamp, Bt., Langley Park, Norwich; Dr. Bastian, 81, Avenue Road, Regent's Park; Dr. Barker, 14, Eaton Place, Brighton; Richard Chaplin, Esq., Admiralty,

Somerset House; Latimer Clark, Esq., Sydenham Hill; Henry Holmes Dobson, Esq., 19, Brompton Square; Daniel Hanbury, Esq., Plough Court, Lombard Street; Wm. Hartree, Esq., Lewisham Road, Greenwich; Geo. Augustus Ibbetson, Esq., 30, Cavendish Square; Jos. Ince, Esq., 26, St. George's Place, Hyde Park Corner; Jno. Jeffryes Oakley, Esq., 182, Piccadilly; Sir Geo. Rendlesham Prescott, Bart., Windsor Cavalry Barrack; Jas. Robey, Esq., Newcastle-on-Tyne; Wm. Hy. Spencer, Esq., Merton House, Belsize Park; Charles Stewart, Esq., 86, Kennington Park Road; Rev. Douglas C. Timins, Hatfield Park, Watford; Jno. Hopkins Walters, Esq., Kingston-on-Thames; Robt. Owen White, Esq., The Priory, Lewisham.

At the next meeting of the Society, announced for October 9th, a paper will be read by Dr. Guy "On the Sublimation of the Alkaloids."

Although the Council would in the ordinary course of things have enjoyed, as they deserved, the repose of a recess, we find that has not been the case during the interval which has occurred since the last meeting. The President and Secretaries have been most indefatigable in their determination to secure better accommodation for the Society, and they have been so fortunate as to obtain, through the courtesy of the authorities of King's College, an excellent apartment, which will henceforth constitute the Library, Reading, and Microscopical Room of the Society, and will be open for the use of the Fellows daily. An Assistant Secretary is in attendance, and gives a certain portion of each day from 11 to 4, as well as certain evenings, to the work of the Society, so that we may say the requirements of the microscopist will for the future be combined in some respects with the comforts and conveniences of a club-room. The Secretaries have most laboriously occupied themselves in the work of improvement. The fittings are neat and convenient. The Library presents an entirely altered and renovated appearance, and many valuable additions have been made to it, rendering it more worthy of a learned body holding the position of the Royal Microscopical Society. Mr. Peters's valuable present to the Society, the "writing machine," can be not only seen but used by any Fellow who will give himself the time and trouble to master its difficulties; the microscopes now bid fair to be made useful; indeed, the member would be very fastidious who cannot thoroughly appreciate or feel satisfied with the earnest endeavours of all concerned in the work of improvement since they last met at King's College.

Quekett Microscopical Club.

June 28th, 1867.

Mr. Ernest Hart, President, in the Chair.

A Paper was read by Dr. Braithwaite, F.L.S., on "The organization of Mosses," which he prefaced with some remarks on the writers on Bryology, and afterwards described the distinctive character of the spores, stems, leaves, reproductive organs, development of the fruit, Sporangium, &c., as well as the habitats of mosses, mode of collecting, examination, preservation, and uses. He concluded his interesting paper by expressing a hope that this little sketch might have the effect of directing the attention of some persons present to a new field of study which he was sure would amply repay those who entered upon it. At the conversazione which followed an opportunity was afforded the members of viewing under the microscopes carefully prepared specimens of the spore, prothallium, antheridia of male flowers, cell structure and capsules showing the modifications of the peristome.

Four members were elected.

July 26th, 1867.

Mr. Ernest Hart, President, in the Chair.

This being the Annual General Meeting of the Club, the following Report of the Committee was read:—

Report of the Committee.

"The completion of the second year of the Quekett Microscopical Club is an occasion on which the Committee and members may fairly reciprocate congratulations on the steady advance that has been made towards the attainment of the various objects, for the promotion of which the Society was originally formed. Experienced microscopists and students of kindred tastes have now regular and frequent opportunities of meeting, to discuss those special subjects in which they are mutually interested, and frequent field excursions under experienced guides, to well-known localities around the metropolis, afford to the members generally, valuable facilities for becoming more intimately acquainted with the haunts and habits of those living organisms which form the subjects of their study or serve to recreate their leisure hours.

"Your Committee desire especially to draw your attention to the very favourable circumstances under which the Club continues to hold its meetings in this noble room, and to inform you that it is wholly due to the well-known liberality of the Council of Univer-

sity College that we are permitted to assemble within these walls free of all charge for rent. The Committee have felt it their pleasing duty to express most cordial thanks for the privilege so generously extended to the members of the Club.

"The interests of the Club have been considerably promoted by the support and sympathy of our President and Vice-Presidents; and it is due to our worthy President to state that he kindly allowed himself to be put in nomination for the Presidency, at a time when the action of the Committee was considerably embarrassed by the lamented and unexpected decease of the gentleman who had been previously nominated for that office.

"During the past year the following Papers have been read, many of them having been illustrated by means of living or mounted specimens.

"*Papers read* 1866–7.

"The President, on 'The Minute Structure of the Iris and Ciliary Muscle.' Mr. Bockett, on 'A new form of Lamp carrying its own Reflector.' Dr. R. Braithwaite, on 'The Organization of Mosses.' Mr. Burgess, on 'Mounting Botanical Objects; on 'Cuticles of Plants.' Mr. Cooke, on 'Transmission of Specimens by Post; on 'The Progress of Microscopical Science in 1866;' on 'Nachet's Principle of Binocular Construction.' Dr. Tilbury Fox, on 'Human Vegetable Parasites.' Mr. N. S. Green, on 'Melicerta.' Dr. Hallifax, on 'Making Sections of Insects.' Mr. Higgins, on 'Otoliths of Fishes.' Mr. Highley, on 'Shore Collecting.' Mr. F. Kitton, on 'The Publication of New Genera on Insufficient Material.' Mr. R. T. Lewis, on 'Some of the Microscopical Effects of the Electric Spark. Mr. S. J. McIntire, on 'The different kinds of Poduræ.' Mr. C. A. Watkins, on 'Yeast and other Ferments.'

"Your Committee, in common with many members of the Club have felt that great advantages would accrue to the members generally, if the Transactions of our meetings were recorded in a fuller and more permanent manner than has hitherto been done. They have accordingly devoted much time and attention to the consideration of the several suggestions which have been submitted to them, but up to the present time they have failed to make such arrangements as they deem would be for the general good of the Club. They entertain, however, the hope that the time is not far distant when satisfactory arrangements may be effected. In the mean time it is very gratifying to the Committee to be able to announce, that in November last Mr. R. T. Lewis kindly volunteered to undertake the onerous duties of Reporter to the Club, and since that period, thanks to his ready pen, and willingness to sacrifice considerable time, exceedingly copious and accurate Reports of our Proceedings have been secured to us.

"One of the features of our recent meetings is the Question-box, which has been placed on the table for the reception of questions relating to microscopic science; such questions, when read to the

meetings on convenient occasions, have generally elicited satisfactory replies.

"Subsequent to our last annual meeting, numerous Field Excursions have been made, and the season 1866 was brought to a satisfactory termination in October last, by a visit to the Royal Gardens, Kew, where, by the kindness of Dr. Hooker, our members were permitted to range freely over that delightful place, and make highly interesting collections. For the present season the Excursion Committee issued the following list of suitable places to which excursions were recommended, and the attendances at those which the weather has permitted to take place, indicate no abatement in the interest hitherto exhibited.

Excursions, 1867.

"April 13th, Hampstead; 27th, Wandsworth. May 11th, Esher; 25th, Chiselhurst. June 8th, Keston; 26th, Excursionists' Annual Dinner. July 13th, Lea Bridge; 27, Grays, Essex. August 10th, North Woolwich Marshes; 24th, Kew (Towing-path). September 7th, Grand Junction Canal.

"The Library of Books of Reference has been extended by donations from the President, Drs. Lankester, Tilbury Fox, and W. J. Gray, and Messrs. Bockett, Bywater, Cooke, Curties, Hardwicke, and Highley, and from the Publisher of 'Science Gossip,' the Publisher of the 'Naturalist's Note Book,' and the Editor of the 'Naturalist's Circular,' as well as by purchase of an entire set of the 'Microscopical Journal and Transactions,' and other works of a kindred character. A commodious oaken bookcase has also been secured to the Club, for the safe keeping and proper working of its growing Library.

"Through the liberality of members and other gentlemen, 140 slides of interesting objects have been added to our cabinet, making the total number 263.

"The duties of Librarian and Curator have been kindly discharged by Messrs. Reeves and Ruffle, who, by their valuable assistance on the evenings of our meetings, have greatly facilitated the distribution of the books and slides to the members.

"It is gratifying to the Committee to observe that one of the original objects for which the Club was formed, viz. the exchange of specimens, has now become a recognised feature, and scarcely a meeting takes place without many interesting specimens being freely distributed amongst the members. In furtherance of this object, and to afford still greater facilities for the exchange of slides, a Sub-Committee has been formed, and they will be glad to receive, through the Secretary or otherwise, any slides for exchange, subject to the Rules (page 28) which it has been thought desirable to adopt, and which have been already sent to every member.

"During the last winter Mr. Suffolk has again enabled the Club

to offer to young microscopists the great advantage of class instruction in the management and use of the microscope. The patience and success with which the course of instruction was carried out during the winter of 1865-6 have been, if possible, surpassed during the winter 1866-7. The Committee feel they would be ill-discharging their duty were they to omit to express to Mr. Suffolk the warmest thanks of the Club for his continued efforts to promote its usefulness.

"Encouraged by the support which the Club has hitherto received from microscopists generally, your Committee ventured, on the 4th of January last, to give a Soirée to the members and their friends. Unfortunately, a frost of almost unparalleled severity prevailed, which rendered locomotion of all kinds nearly impracticable; but notwithstanding this great impediment to success, there was a large attendance of ladies and gentlemen on the occasion.

"Since the last Annual General Meeting, 130 gentlemen have enrolled themselves as members of the Club, and during the same period 12 names have been removed from the list of members in consequence of death or other causes, leaving the present number of members at 273.

"Such is a brief epitome of the history of the second year of the Quekett Microscopical Club, by which it will be seen how far the objects for which it was formed have been attained, and how much may be done to advance the cause of science, whilst seeking new and boundless fields of enjoyment. In conclusion, your Committee desire to impress upon members the conviction, that as the usefulness of the Club and the small amount of subscription are made known to their respective circles of friends, the number of members cannot fail to be considerably augmented."

The Treasurer's Report, showing a satisfactory balance-sheet was read.

The members then proceeded to the election of Officers for the ensuing year.

The PRESIDENT.—The Scrutineers are now finishing their work, and I beg permission to take my leave of you before I am formally extinct; for a very few minutes more will put an end to my official existence. I value very highly the honour you did me in offering me the distinguished post of President, and that, for the most part, without a personal knowledge of me, or even of my fitness for the office. But, whatever may have been expected of me, I hope I have been able in some measure to fulfil those anticipations. For my own part, I have endeavoured to do my duty to the Club as far as I could. The President of a Society of this kind is, however, in truth one of its most unimportant members: he is to it what a monarch is to a limited monarchy, a sort of State puppet to perform the nation's will. I hope I have been able to perform those duties satisfactorily. I have some reason to believe, from the kind receptions which you have given me,

that you are so satisfied; and this has been to me a matter of great gratification. But what has been to me another real source of gratification is the remarkable success which has attended the operations of the year. It has been said that to deserve success is better than to win it; yet there is a pleasure in winning which, at the time at least, is as great as in deserving, and success deserved, but not won, has its own bitterness. The success which has attended this Club is, I believe, entirely deserved. It aims at doing more than it seems to do. It pretends only to be a Club for the purpose of reunion and work in an unpretending way; but if we look back upon the past proceedings of this Club, at the papers which have been read, and at the work accomplished, we shall see great cause for congratulation at the solid and serious work done. The list of papers certainly will bear comparison with that of any other Microscopic Society. We have had some papers which will continue to be remembered, and to exercise an influence upon our minds. Dr. Tilbury Fox's paper upon "Parasites" opened up a great variety of questions in relation to the causation of disease in men, plants, and animals, which have yet to be solved, and the answers to which must be sought in the work of the Club, and few more profitable inquiries exist than those which seek to trace and to analyse the prevalence of microscopic forms at periods of epidemic disease, and attempt by patient observation to connect the one with the other, whether merely correlated or otherwise. And I may observe that this is just the kind of work in which the greater number of members appear likely to engage; for, so far as I have observed, their bias seems to be to work amongst the lower organisms. I may also mention Mr. Lewis's suggestive paper on "The Microscopic Effects of the Electric Spark;" Mr. Highley's, on "Shore Collecting;" Mr. McIntyre's, on "Poduræ," a paper of particular interest; and Mr. Green's, on "Melicerta." Mr. Cooke's "Retrospective View of Microscopic Progress" ought to be in the hands of every member; nor should I omit to notice Dr. Braithwaite's exhaustive memoir on the "Organisation of Mosses." The enumeration of these valuable papers makes me the more regret that there is no official mode of recording the transactions of the Club. I was offered, some time since, an exchange of Proceedings with a Brussels Microscopic Society, but we had none to offer in return. If we had transactions to exchange, we should have a means of communication with other Societies, and this might be the means also of maintaining a high standard of papers; for if it were known that publicity were to be given to their work, members would be induced to do their utmost to bring forward their best efforts. But on this point I am glad to be able to announce that a Sub-Committee has been this day nominated to go into this question, and to ascertain what can be done in it; and I hope it will fall to the lot of some future President to detail satisfactory results. I do not intend to review all the work of the past year; that has been referred to in the

Report, from which it will be seen that all the various branches are working satisfactorily. I must also congratulate you upon the state of your funds, and upon the fact of an addition of 130 members during this year, bringing up the total number to nearly 300 in the two years, which is about the number that the Secretary suggested to my budding ambition as being what we might hope to attain, and which might be considered as a proof of unequivocal success. It is a success which leads me to hope that the next President may be able also to congratulate the Society upon an increase of 130 more members at the end of the ensuing year. This accession to our numbers is not merely a nominal increase; it has brought us an important increase of members attending our now extensive meetings, and we see the same faces again and again at different meetings, so that we cannot regard it as a mere nominal success. You may have a Society, you may have a large subscription list, great objects, and an excellent Council; but you must not forget that to have these alone will not constitute a success, unless the members are a working body, unless the papers produced have an interest for the members, and the members have an inward feeling of pleasure in coming here to hear the papers. I hope that the members will continue to take a more active and a more personal interest in the subjects discussed, and I think I can see that there is that interest growing. There may be in a young Society some difficulties at first, and the members may feel some diffidence at speaking and working together at first; but it is essential that such feelings should vanish. We look on the "Question Box" as a means of bringing members more into communication with one another, by bringing out subjects in which some feel personally interested, and by which that interest may be communicated to others. Unless this is accomplished, we do not fulfil our objects; we are not in the course of a successful career. As regards the papers read—if I may make one remark by way of criticism, using this only opportunity of drawing your attention to it—I think I see—I may be wrong—but I think I see a tendency to exaggerate the importance of the study of external form, shape, and structure, and to prefer these to the higher forms of microscopic work, the investigation of development of that structure, and the meaning of that which is studied. It may be only the accident of the character of the Club, but it seems to me that with many of the members the besetting temptation is to mistake the means for the end. There is, I know, a great pleasure in the mere manipulation in the preparation of objects, the making thin sections, putting them up in new solutions, getting forms rare and beautiful. These are all legitimate objects, but they have a tendency to tempt us away from the higher work of the microscope, which is not that of mere amusement, and does not consist merely in the collection of rare and beautiful objects. It should be remembered that the microscope is an instrument of research, and not a mere toy, and it is its real use which ought rather to

be cultivated by this Club. Amusement and research are not by any means incompatible, and I should be the last to suppose that there is no benefit to be derived by working in the way I have referred to, for the contemplation of minute organisms is in itself a means of intellectual recreation, and, indeed, deserves to be classed amongst the higher kinds of mental cultivation. But the true microscopist—the man whom Quekett would have delighted to honour—is he who looks through form and structure to discover uses and laws, who is never contented with endeavouring to ascertain what are the relations of a structure merely as a means of systematizing; because I hold that the mere study of systems is again but a means to an end, so that there also I seem to see a frequent waste of powers which, had they been directed otherwise, might have led to far greater results. I should name as typical microscopists such men as Schwann and Schleiden, who looked into matter with a view to discover its inmost nature, to reveal to us all the secrets of structure and function. Those who indulge in microscopy, and ally to it physiology and pathology, may truly feel that they are pursuing a path most worthy of the human intellect. This kind of study is allied to the work of the astronomer, who seizes upon objects alike invisible to the unaided eye, to derive therefrom a rule of law and a perception of order, and to deduce principles which shall lead us to a perfect comprehension of the laws of the universe; so also may the microscopist discover principles which, when we apply them to science, may be useful not only in medicine, but in mechanics and applied sciences. I have always felt that in those first great truths which Schwann and Schleiden disclosed to us, that first central fact of a cell structure and what we may call the laws of cell growth, there was disclosed to us a fact as great as any of those which Newton's physical science disclosed to the physicist. We have learnt to regard this as a kind of unit, out of which, from infinite variations, the great variety of material forms are created, and to recognise the cell as a first form of created structure, whilst in it we seem to have reached the first elemental condition of matter in which we can recognise laws. We may never penetrate so far as to recognise the source of force, but we can trace the changes by correlation from one phase to another. We can observe the great forces, gravitation, and chemical action, acting in a mere initial and elementary condition; indeed, we may view all these great forces chained within the limits of the microscopical cell. There we can watch their action upon as grand a scale within the thousandth of an inch as when heaving throughout vast masses of matter, and we there recognise the primal forces employed and all the laws which govern them.

The physician, the physiologist and the pathologist find in the microscope another sense by which to investigate the tissues whose secrets are yet more than half unknown. The naturalist, whether zoologist or botanist, learns by its aid to see "all nature in the smallest things." We can admire the endless beauties and varie-

ties of form; we can gratify the æsthetic sense; and the love of the marvellous even by the unscientific and untaught cultivation of its use as amateurs. But let us seek here to put it to its highest uses, to cultivate its highest objects, to learn its noblest lessons.

I hope I have not dwelt unduly upon this point, but I may be permitted to conclude by expressing my great gratification at the working of the Society; and in congratulating its members I may express the hope that its future success may be even greater than it has been in the past.

The Scrutineers having handed in their Report, the following gentlemen were declared elected as officers for the ensuing year:—

President—Arthur E. Durham, F.L.S. *Vice-Presidents*—Tilbury Fox, M.D.; Ernest Hart; William Hislop, F.R.A.S.; John K. Lord, F.L.S.

Treasurer—Robert Hardwicke, F.L.S. *Secretary*—Witham M. Bywater.

Committee—W. J. Arnold; N. Burgess; S. J. McIntyre; J. Slade.

Mr. M. C. Cooke was elected Honorary Secretary for Foreign Correspondence.

Nine members were elected.

August 23*rd*, 1867.

Mr. Arthur E. Durham, President, in the Chair.

Mr. R. T. Lewis read a Paper "On a Microscopical examination of *Mermis nigrescens*." In the course of which he gave a lucid and interesting account of the appearance of this hair-worm in large numbers on the morning following the night of June 2nd, when a heavy thunderstorm passed over the Southern Counties. They were found suspended from the leaves of apple-trees and shrubs. Sudden appearances of immense numbers of them took place in the years 1781, 1832, and 1845, on each occasion in the month of June, and immediately after thunderstorms with heavy rainfall. Their appearance on June 15th, 1845, has been described at great length by the Rev. L. Jenkyns in his "Observations on Natural History." Mr. Lewis's paper entered very minutely into the microscopical structure of the worm, and was illustrated by coloured diagrams and by specimens prepared to show the chief points of interest, which were exhibited under microscopes in the room.

Twelve members were elected.

Dublin Microscopical Club.

18th April, 1867.

Mr. Crowe showed some hairs from the nest of the larva of a species of Oiketicus, from Australia. These hairs, of which the felt-like wall of the nest, some inches in length, was constructed, formed a curious object. They were cylindrical, general form clavate towards the extremity, but armed there by a number of thorn or spine-like prolongations, pointing towards the extremity of the hair.

Dr. Collis exhibited crystals of cholesterine and epithelial scales from an encysted tumour; also sections of cancer-tissue, stained with carmine, and explained the process.

Mr. Archer exhibited fine conjugated examples of *Closterium rostratum*, showing the well-known characteristic form of this pretty zygospore.

Rev. E. O'Meara showed several new diatoms from the Arran gathering—one the type of a new genus, named Wrightia, after Dr. E. Perceval Wright. Full descriptions, accompanied by Mr. O'Meara's drawings of the form, will appear in this Journal.

Dr. Reynolds showed, under the polariscope, some crystals of Santonine, forming a very fine and gorgeous object.

Mr. Dawson exhibited some remarkably fine and vigorous specimens of *Bacillaria paradoxa;* these were in full and active movement, and the ever fitful changes of position of the frustules were well shown.

Mr. Archer showed two forms of freshwater Radiolarian Rhizopoda, both seemingly new and noteworthy. One of these appertained to Actinophrys; it was remarkable, owing to a peculiar differentiation of the body into two sharply marked distinct strata, differently characterised in colour and structure. Though a greatly more minute animal, this differentiation is still more marked than that shown by *Actinophrys Eichhornii*.—The other form might be compared to an Actinophrys enclosed within a perforated hollow globe, and emitting its pseudopodia through the apertures, but it really seems to possess a greater affinity with certain marine forms, and, leaving out of view the want of the "yellow cells," to find its nearest allies amongst the Ethmosphærida, close to Heliosphæra. As a figure of these forms would, however, convey an idea of their nature far more readily than a hasty description, Mr. Archer would defer any more extended allusion to them till another opportunity.—He was able again to exhibit examples of the curious form he lately brought forward under the name of *Raphidiophrys viridis* (Minutes of 20th Dec., 1866);

these were taken from the same locality as before. It was, he thought, interesting to find this remarkable freshwater form again in spring, it having been first met with in autumn of last year. Mr. Archer ventured to think that the exhibition of these three seemingly remarkable forms of freshwater rhizopods, side by side, would not be thought without interest; and, in bringing them forward, he ventured to enter into some detail in endeavouring to point out their peculiarities, as they seemed to him; and this he was the better enabled to do by simultaneously drawing attention to some of the commoner forms which happily presented themselves—if his remarks might have been thought prolix, at least the objects themselves had the claim of novelty.

Dr. A. Dickson showed preparations from the stomatic region of the epidermis in Taxus and Sciadapitys. In Taxus the epidermis cells around and between the stomata appear as if flatly tuberculated on their free surface. This apparent tuberculation, however, is due to bulging of the cell-wall from within. There is thus, as it were, an elegant *repoussée* pattern on the surface of the epidermis. In Sciadapitys Dr. Dickson found this "*repoussée*" bulging to be much exaggerated, so that, instead of exhibiting a comparatively flat tuberculatum, the surface was expanded into hollow spine-like papillæ.

16*th May*, 1867.

Mr. Archer showed a variety of Desmidieæ conjugated. These zygospores were some of them only rarely seen, some never before.

Amongst them was the zygospore of *Micrasterias rotata*. This is large and orbicular, and is beset with rather large and long, but not very numerous, subulate spines, thus unlike the zygospore of *Micrasterias denticulata* (see 'British Desmidieæ,' plate vii, fig. 1 *f, g*)—the more ornate form having the less ornate zygospore. Numerous examples always presented the same characteristics, and as these slender, tapering, pointed spines were proportionately quite as long, if not, indeed, a little longer than the more elaborate branched spines of *M. denticulata*, it could hardly be assumed that the branches had not yet begun to develope themselves. It is thus interesting to observe the individuality seen in the parent forms of these two distinct, but no doubt closely related species, still further expressed and maintained in the zygospores. The zygospore of this species had not yet, so far as Mr. Archer was aware, been recorded.

Desmidium Swartzii was also conjugated. This seems, although a very common, oftentimes abundant, species, to show the conjugated condition but rarely. The present specimens were quite like that so graphically figured in 'British Desmidieæ' (pl. iv, fig. *f*). But Mr. Archer's object in drawing particular attention

to it on the present occasion was to urge that Ralfs was in error in his description of the example from which his figure was taken ('British Desmidieæ,' p. 62). Ralfs supposed the appearance presented to be that of the contents of each cell of a solitary filament having become massed together in the cavity of each, without any actual conjugation having taken place. Alex. Braun, supposing, too, that this was hardly what had taken place in the specimen figured by Ralfs, suggests that it might represent a filament bearing the spores, but which had been detached from its companion filament, such as we see frequently in Zygnema, &c. ('Rejuvenesence in Nature,' p. 296). This, however, is not the case, neither is Ralfs correct in supposing these spores to have been produced simply by the consolidation of the contents of the joints of a solitary filament. Ralfs' figure, Mr. Archer had now no doubt, represented identically the same condition as that now exhibited, and he had as little doubt but that in both instances two filaments, not one only, were concerned in the process. The species conjugates in a manner quite comparable to that of Zygnema by mutual tubular processes, and the zygospores are formed not in the cells of one of the parent filaments, but in the transverse intervening space. So short, however, are the intervening processes uniting the opposite conjugating joints, and so closely approximated are their flat sides, and they adhere so intimately, that the whole is very deceptively like a single filament only, as Ralfs supposed, and the figure is indeed a most excellent likeness of the *appearance* presented. The true condition is correctly depicted by Wallich in a Bengal form ('Ann. Nat. Hist., 1860,' pl. vii, fig. 4), where the filaments do not, however, approximate so closely during conjugation as those of *D. Swartzii.*

Mr. Archer was likewise able to bring forward on the present occasion the zygospores of *Xanthidium fasciculatum*, of *Closterium juncidum*, of *Closterium lineatum*, and *Closterium acútum*, each presenting their own marked and characteristic form.

He was likewise able to present two forms not hitherto met with in Ireland—*Docidium baculum* (Bréb.) and *Euastrum circulare*, var. β (Ralfs). As to the former (*D. baculum*), although it is said by Ralfs to be rather common in Wales, yet it almost looked as if it was not going to turn up in this island, its place seemingly being taken by the frequent *Docidium Ehrenbergii*; yet here was a gathering made near Carrig Mountain in which it occurred pretty abundantly. As to the other form not hitherto met with here *Euas. circulare*, var. β Ralfs = *Euas. sinuosum* (Lenormand), it seems quite a distinct thing from *Euas. circulare* (Hass.). This was the first time Mr. Archer had ever seen any of the forms included by Ralfs under Hassal's name, *Euastrum circulare*, yet a glance showed it was very distinct indeed from any of the commoner related forms, and not only so, but he felt pretty well satisfied that the forms α, β, γ, were themselves distinct from one another. Only a very few specimens turned up from a bog near

Carrig Mountain. For the present, therefore, Mr. Archer felt he must regard this form not as *Euastrum circulare* (Hass.), nor as any variety of that form, but as *Euastrum sinuosum* (Lenormand).

Mr. Andrews showed crystals of sulphate of iron.

Dr. Frazer exhibited curious little globules obtained from coal ash by Mr. Dancer, and found in furnace dust; they formed a remarkable object.

Dr. Moore showed *Monormia intricata* from the Botanic Garden.

Rev. E. O'Meara showed a new Pinnularia from Arran, which will appear with a figure in this Journal.

Mr. Archer again showed a sample of that elegant rotiferon, *Conochilus volvox*, taken from the "Rocky Valley." On the previous occasion that he had found this fine species the specimens were met with near Carrig Mountain.

June 20th, 1867.

Dr. Moore exhibited the elaters of Marchantia, elucidating thereby the exceptional but not unprecedented occurrence of spiral fibre in the cells of Cryptogamic plants, and pointing out at same time that an acquaintance with such objects was necessary to those whose researches were mainly confined to aquatic organisms, as not unfrequently these bodies may be found presenting themselves in water at the risk of being mistaken for something independent.

Dr. J. Barker exhibited hairs of shrew-mouse.

Rev. E. O'Meara exhibited a new Triceratium from the Arran gathering; also a peculiar five-sided form of *Amphitetras antediluviana*, thus proving that the number of sides is really a character of but slight value or importance. Figures of the forms shown by him will appear in this Journal.

Mr. Archer showed a minute alga new to Britain, *Cosmocladium Saxonicum*, de Bary. This had been taken by him on a recent hurried visit to North Wales, and was found in a pool close by a little lake called Lake Elsie, near Bettws-y-Coed. He referred to de Bary's account of this little plant, and exhibited his figure from the 'Flora' (No. 21, 1865). This is so accurate that there could be no doubt whatever as to the identity of the present plant with that of de Bary, being alike in form of cells, arrangement of contents, nature of stipes—all. There may, however, be a question that this plant is actually distinct from *Cosmocladiam pulchellum* (Bréb.), for the differences may be but seeming, owing to de Brébisson having most probably mistaken

the parallel pair of slender stipes for a single broad band-like one. If he has really done so, the distinctions then would be reduced mainly to de Brébisson's plant being attached (by the stipes) to Confervæ, whilst de Bary's is free; the central point of the colony having been formerly occupied by the primary or original cell. It seems strange that de Bary does not allude at all in his paper to the resemblance of Cosmocladium to Nägeli's genus Dictyosphærium. Mr. Archer would refer to it, however, not as indicating a real affinity, for de Bary had no doubt proved Cosmocladium to belong to Desmidieæ, while there could be little doubt Dictyosphærium did not. But there is still sufficient resemblance to justify a simultaneous allusion to them. In Dictyosphærium (of which three species are known) the cells (differently figured according to the species) are supported on dichotomously branched slender stipes, originally starting from a common centre. Simultaneously with the division of the peripheral cells of the group, a new branching of the stipes takes place, so that each ultimate branch is surmounted by a cell. In *D. Ehrenbergianum* the stipes are exceedingly slender and delicate, more pronounced and coarser in *D. reniforme* (Bulnheim), and most so in a species Mr. Archer had brought forward, *D. constrictum* (ejus), and described in Minutes of October 19th, 1865. But, apart from the Desmidian character of the cells themselves in Cosmocladium, the genus Dictyosphærium is distinguished by the stipes being single and filiform, not double and expanded intermediately, and the cells both intermediate and terminal. Still, apart as these two genera must be placed, their outward resemblance to one another justifies this brief allusion to them. The cells in both grow in families or colonies (Stöcke, de Bary), in both they are supported on stipes, the stipes in both exceedingly slender, delicate and colourless, seemingly in both a more dense filiform development of similar gelatine to that which encompasses the aggregate family; and moreover in one species, *Dictyosphærium constrictum*, Arch., the cells are notably constricted. Hence there is some probability that they might be confounded by observers, or referred to one and the same genus. But apart from the differences of stipes and habit of growth above alluded to, see de Bary's paper (l. c.) for indubitable proof of the position of Cosmocladium in the Family Desmidieæ—both forms, if distinct, representing a Cosmarium mounted on a stipes whilst the new growths in Dictyosphærium is by simple division into like daughter-cells, and the genus must seemingly take its place in Palmellaceæ, near Mischococcus (Näg.).

Dr. Richardson exhibited the various stops he had contrived to be fitted under the stage of the microscope for viewing the markings on diatoms, but as there was no stand present to which he could adjust them, he was obliged to defer showing them in use.

Mr. Archer showed the circulation of the cell-contents in Nitella, a trite but always a highly curious spectacle.

Reading Microscopical Society.

The members of this Society, which has now been established for more than six years, gave their third soirée on the 2nd April last. The members and their friends, amounting to about 400, amongst whom were included the *élite* of the Society of the place, assembled in the Town Hall soon after 7 p.m. About thirty microscopes were distributed round the room, and Mr. Baker, the well-known optician of High Holborn, had also kindly sent down half-a-dozen of his capital instruments, including one or two of his new and convenient portable field microscopes, which attracted considerable attention. The objects were of the usual popular kinds, and a large proportion of them had been prepared by the members themselves. In the course of the evening a short oral address was delivered by the President of the Society, Capt. Lang. He said—

Ladies and Gentlemen,—On me devolves the grateful task of welcoming you to this third soirée of the Reading Microscopical Society, in the name of the members generally. We are much pleased and gratified at meeting such a large assemblage of our friends here this evening, not only because of course we are delighted to see them, but because their presence shows us conclusively that these sorts of semi-scientific meetings are now appreciated in this town. Soon after I came to reside amongst you, now some eight years ago, two or three of us banded ourselves together to form a small Microscopical Club, but there were not wanting persons who told us that our project would never succeed, that all scientific associations of whatever kind were utter failures in Reading, and that ours would be no exception to the general rule. Now, I am glad to say that these croakers have proved false prophets, for our small club has gradually swelled into a considerable society, numbering as it does now some twenty-five ordinary members, and thirty-four honorary members. We are much indebted to these latter ladies and gentlemen for joining us, and so indeed should you all be, as it is by means of their small annual subscriptions that we are enabled to give occasional entertainments of this kind to our and their general friends; but I hope to see these honorary members, in future, more frequently at our ordinary meetings. I am sure the benefit would be mutual, for as they must be more or less interested in natural history pursuits, we should doubtless gain occasional information from them, whilst, probably, they would learn something from us as to the microscopical anatomy of the vegetable and animal world. As to our ordinary members, I think I may fairly say that we now boast of several thoroughly good working microscopists—gentlemen who in the course of their investigations stumble every now and then on minute forms of life hitherto unknown to science, and gentlemen who can prepare and

preserve objects for the microscope as well as the best professional mounters in London. In corroboration of the first part of this statement, I may tell you that we have lately been rather amused by reading in a recent number of a scientific journal a description by the eminent naturalist, Mr. Gosse, of a supposed new Dinocharis, to which he has given a specific name in honour of its supposed discoverer, but with which little creature we have been perfectly well acquainted for the last four or five years, and possess drawings of it made as far back as that period; whilst in this very month's 'Intellectual Observer' Mr. Slack, another microscopist, announces, as a discovery, that *Vaginicola valvata*, hitherto supposed to be confined to a marine habitat, is to be found also in fresh water! Why, ladies and gentlemen, we could have informed Mr. Slack of this fact years ago, and could send him as many specimens as he might wish for, from the ponds and ditches of this neighbourhood! As to the latter part of my statement, I need only say that I know at least of one gentleman who thinks it a very easy matter to dissect out the gizzard of a flea, skin it, clean it, lay it out so as to show its structure, and then mount it permanently as an object for his cabinet, whilst many of us find no difficulty in extracting the teeth of small slugs or snails, cleaning, and mounting them for the microscope.

At our last soirée the objects under the microscopes were arranged on a systematic plan. We attempted to show you the gradual growth of both vegetable and animal, from the primitive cell to the higher organism. To do this we were obliged to exhibit objects which, though intrinsically interesting, were not very striking to the eyes. On this occasion we pursue another plan. Each member will exhibit such objects as he thinks will be most pleasing to his friends; they will therefore be of a prettier and more popular kind; but it must be remembered that each specimen must have a history of its own, and I am sure that every member will be delighted to give an outline of that history to those who are not satisfied with the mere gratification of the eye, but would wish to know something of the nature of the object he is looking at. Under some of the microscopes are placed a few of the more interesting species of *Infusoria* and other minute aquatic creatures that crowd in countless myriads the pools and ditches of our meadows, and I am sure that those persons who have never seen them before this evening will leave this hall, after having done so, with a higher sense of the inexhaustibility of nature and of the creative power, if I may use the expression, of the Almighty. (Captain Lang then cited several well-known cases, proving the practical use of the microscope in the every day affairs of life, and in continuation said)—

Probably many of you ladies have read with interest the discussions that have been going the round of the papers relative to the parasitic gregarines of the present fashionable chignon. For my own part I consider the whole matter a gross exaggera-

tion, but if any lady here wears a chignon and would wish to test its purity, one of our instruments shall be at her service this evening for that purpose. The pores of the skin, examined under the microscope, appear as deep cavities; in these extraneous matter collects, vulgarly called dirt, and if it is not removed by ablution, a suitable soil is soon formed for the minute fungus, which grows and spreads over the skin precisely in the same way as the lichen spreads over the trunk and limbs of the tree.

In passing round the hall I am sure you will all be struck with the beautiful series of drawings exhibited here this evening by two of our members, Mr. Tatem and Mr. Clayton. They are peculiarly interesting and instructive, for it must be remarked that they are not mere enlarged diagrams, but that they have been carefully drawn from the animals themselves as they appeared under the microscope by means of the camera lucida, so that their outline, and the number of times they are stated to be magnified, *must* be correct, whilst you will doubtless admire and appreciate the artistic skill which these gentlemen have displayed in finishing them off.

And now, ladies and gentlemen, I have only to say that we all hope that you will spend an amusing and instructive evening in examining the objects under the instruments, which will be changed at frequent intervals.

The President's address was listened to with marked attention, after which the company dispersed to examine the objects and the beautiful collection of drawings alluded to; and after passing a pleasant and interesting evening, and partaking of the refreshments hospitably offered to them, departed about ten o'clock to their homes.

Microscopical Section of the Manchester Literary and Philosophical Society.

Ordinary Meeting, 25*th March*, 1867.

On the Microscopical Examination *of* Coal Ash *or* Dust *from the* Flue *of a* Furnace, *illustrated by the* Microscope. By J. B. Dancer, F.R.A.S.

When coal is burnt in a furnace to which atmospheric air has free access, a portion is converted into gaseous and volatile matter; and the incombustible substance which remains is the ash. The amount of ash in coals from different localities is very variable ; it is said to range from 1 to 35 per cent. The ash or dust which is the subject of this paper was collected from the flue of my steam boiler furnace, in which common engine coal is used as fuel. This coal leaves a considerable amount of incombustible matter. A specimen of the dust is now before you ; it is of a reddish-brown colour, and free from soot or car-

bonaceous particles.* When this dust is examined under the microscope with a power of forty or fifty diameters, it is found to consist of ferruginous matter and crystallised substances, some particles transparent, others white and red. It contains also a number of curious-looking objects, which vary considerably in size and colour. The majority of these bodies are spherical, and when separated from the irregularly shaped particles forming the bulk of the dust they become interesting objects for the microscope. I shall confine my remarks more especially to these globular bodies. Some of these are as perfect in form as the most carefully turned billiard balls, and have a brilliant polish. The various colours which these globules exhibit give additional interest to their examination. Some are transparent crystal spheres, others are opaque white, many are yellow and brown, and variegated like polished agates or carnelian of different shades. The most abundant of the highly polished balls are black; there are others which look like rusty cannon balls—some of these have an aperture in them like a bomb shell, and many are perforated in all directions. To obtain these objects the dust should be washed in a bowl and all the lightest particles allowed to float away; the remainder consists of fragmentary crystalline and ferruginous substances; mixed with these are the polished balls described, which, under the microscope, by a brilliant reflected light, look like little gems. To separate the spherical bodies from the irregular ones it is only necessary to sprinkle some of this material on an inclined glass plate, and by gentle vibration the balls roll down, and can thus be collected. Having satisfied ourselves with the examination under the microscope, it is natural that we should desire to know more about these novel objects. What is their elementary constitution? Why are they spherical? How do they get into the flue? I have not attempted a chemical analysis of these minute bodies, many of which are less than the 100th part of an inch in diameter. I can only therefore offer an opinion as to their probable constitution, judging from what is known of the chemical analysis of coal ash, and from the appearance they present under the microscope. Referring to the chemical analysis of coal ash, we find that it sometimes contains silica, magnesia, alumina, sesqui-oxide of iron, lime, soda, potash, sulphate of calcium, anhydrous sulphuric acid, anhydrous phosphoric acid, sulphur, and sometimes traces of copper and lead. The vegetable origin of coal is now generally admitted, and doubtless some of the substances I have just named have been taken up by the coal plants, whilst other portions may have collected in the locality where the coal was formed. As this is not immediately connected with our present inquiry, I proceed to speculate as to the constitution of these globular bodies. The transparent spheres I imagine to be silicates of soda or potash; the opaque white are most likely silicate of soda of potash combined with lime and alumina; the yellow and brown are silicates coloured by iron in different pro-

* My attention was drawn to this subject by Mr. Johnson, of Wigan, in November, 1860.

portions. The black globules are not all alike in composition; some of these are silicates coloured by carbon, others are iron balls coated externally with a silicate. Many of these rusty cannon balls are probably ferrous oxide formed by the action of heat on the iron pyrites in the coal. There are also balls of black magnetic oxide; the perforated shells are probably ferrous sulphides. The globular form of these bodies suggests that they have been thrown off in scintillations, such as are seen during the combustion of iron in oxygen gas, and whilst in a fluid state they assume a spheroidal form. They are carried by the draught into the flue, and being of greater specific gravity than the carbonaceous matter forming the smoke, they fall before the current of air has reached the chimney. Some of the dust has been a considerable time in the flue, exposed to the intensely heated circulating flame; the reducing action of this would probably convert some of the oxide into metallic iron. Many of these balls have the appearance of reduced oxides. The flue dust contains a larger amount of ferruginous matter than can be accounted for by the analysis of coal ash. I think the surplus may be regarded as representing the wear and tear of the iron work about the furnace, such as fire bars, boiler plates, &c. The brick work and cement about the boiler and flues may also supply some of the silica, alumina, and iron for these balls, numbers of which are merely thin shells. The movements of these objects, caused by the approach of a magnet under the stage of the microscope, are somewhat amusing, and it is at times startling to see the crystalline objects, both spherical and irregular, exhibit magnetic attraction: probably they contain particles of iron imbedded in them; if they do not, may we not imagine that there is some magnetic compound in which the crystalline matter predominates? When we consider the accidental condition under which this matter has combined, it is just possible that some new molecular arrangement or combination of elements may have taken place. It is very probable that many of these polished balls are much more complex in their elementary constitution than I have stated. They are in fact a kind of glass, and many of them merely bulbs. Pelouze states that glass is probably an indefinite mixture of definite silicates. Glass, containing small quantities of ferrous oxides and sodic sulphates, when exposed to sunlight becomes yellow, and possibly some of these balls may have changed in colour since they came from the flue. Hydrochloric and nitric acid exert very little action on the ferruginous globes: this may be due in some measure to the high temperature at which the oxides have been formed; in other cases they are no doubt protected by an external coating of some silicate. It would require much time and patience to collect a sufficient number of each kind of these minute objects for a chemical analysis; but the spectroscope might probably assist in revealing their constitution. When time permits I hope to resume the subject.

INDEX TO JOURNAL.

VOL. VII, NEW SERIES.

ERRATA.

In line 29, page 65, *for* "wall," *read* "well."
„ 29, „ 68, the word "not" must precede the word "unimportant."
„ 2. „ 69, *for* "vibrious," *read* "vibrios."
„ 9, „ 69, before "nitric acid," insert the words "experiment with."
„ 30, „ 69, insert a "comma" after "Ehrenberg."
„ 25, „ 71, *for* "transmitted," *read* "reflected."

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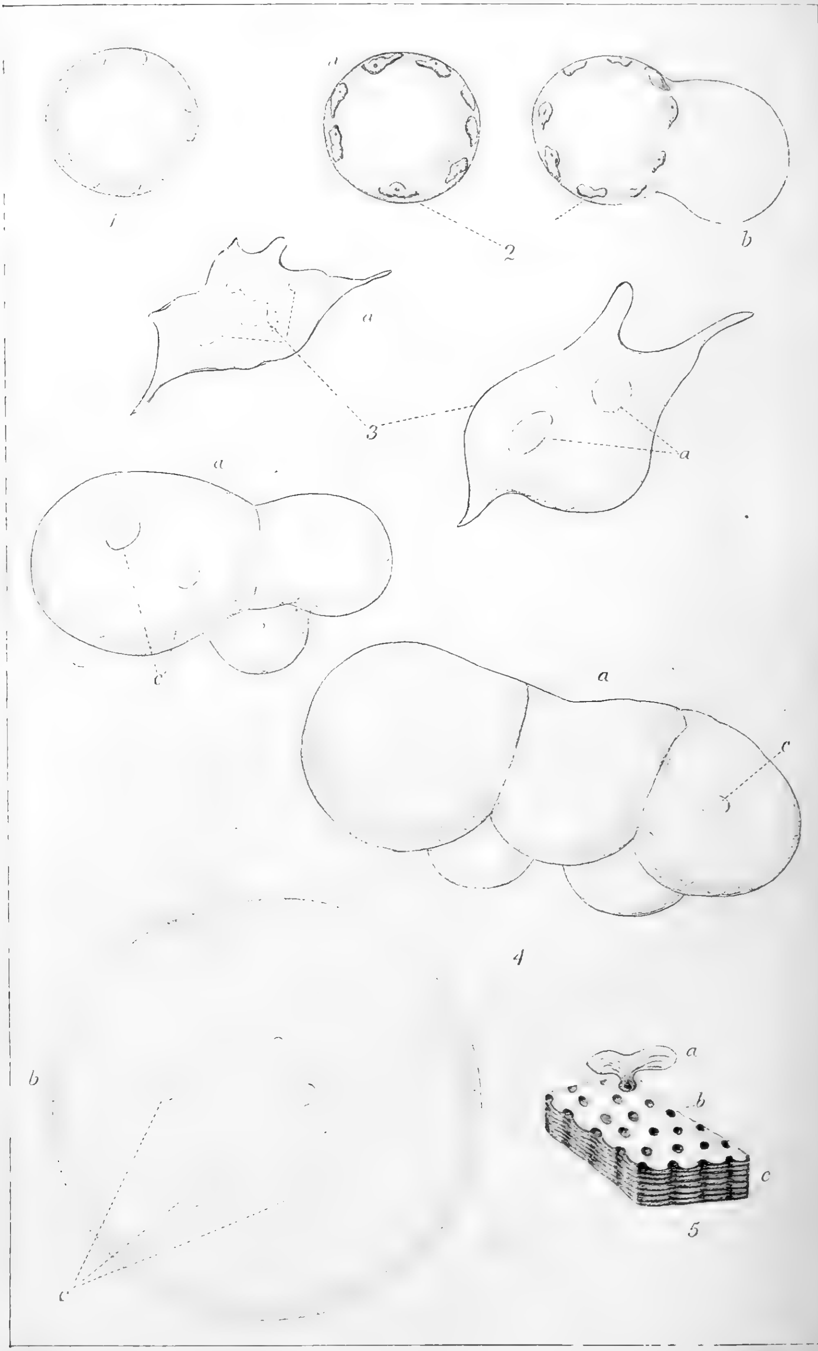


Tuffen West sc. W. West imp.

JOURNAL OF MICROSCOPICAL SCIENCE.

DESCRIPTION OF PLATE I,

Illustrating Dr. Ransom's paper on the Structure and Growth of the Ovarian Ovum in *Gasterosteus leiurus*.

Fig

1.—Free germinal vesicles, its spots unchanged by the medium in which it is examined.

2.—*a.* Free germinal vesicle, of which the spots are changed by the action of water.

b. A similar vesicle, of which the wall is raised at one part, showing the colloid mass.

3.—Free germinal spots acted on by water. Examined by a higher power.

a. Vacuoles.

4.—*a, a.* Germinal spots fusing together in a 5 p. c. solution of chloride of sodium.

b. Large pale drop, the result of such fusion.

c. Vacuoles.

5. Diagram to illustrate the structure of the yelk-sac.

a. Button-shaped villus.

b. Dotted outer surface.

c. Cut edge.

JOURNAL OF MICROSCOPICAL SCIENCE.

DESCRIPTION OF PLATE II,

Illustrating Mr. Lewis's paper on the Microscopic Effects of the Electric Spark.

Fig.

1.—Perforation by electric sparks from an induction-coil through coarse blue-laid post paper.

a. Scorched margin.

b. Perforation.

c. Disrupted fibres.

2.—Perforations by same through thick card.

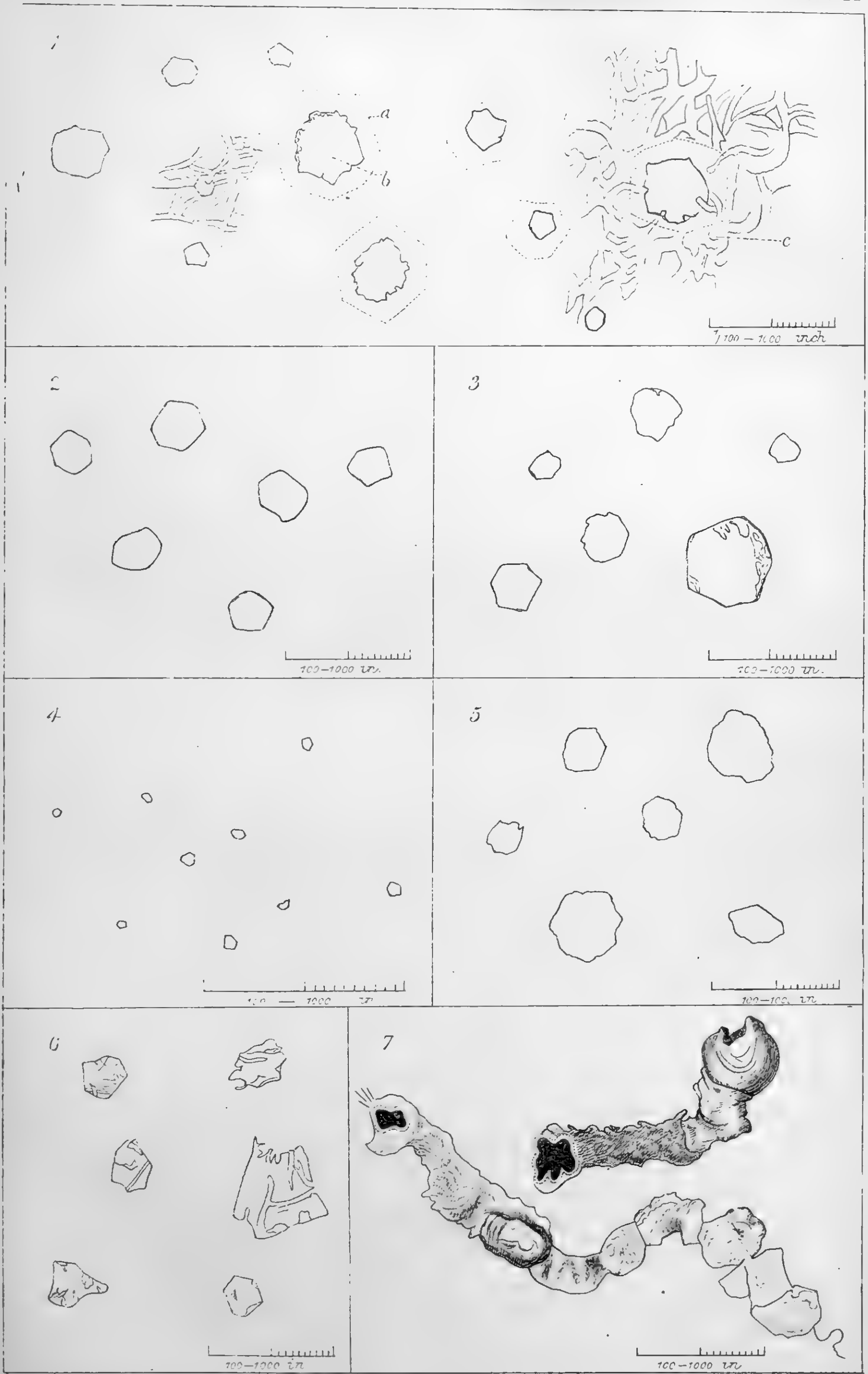
3.—Ditto through varnished card.

4.—Ditto through thick cream-laid note-paper.

5.—Ditto through insulating waxed paper.

6.—Leyden-jar sparks through thick card.

7.—Induction-coil sparks through thin microscope glass.



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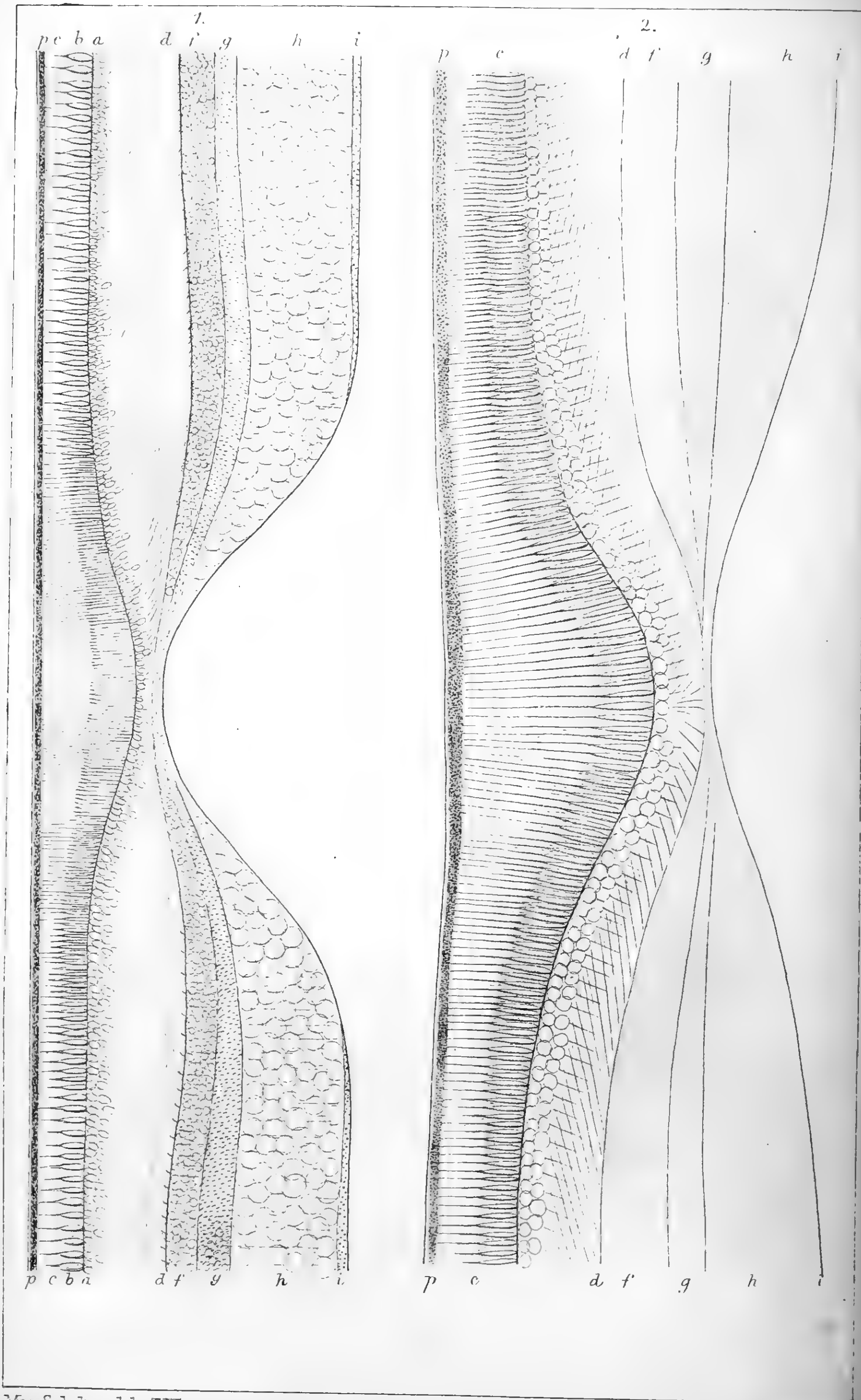


Max Schultze del. T. West sc.

W. West imp.

DESCRIPTION OF PLATES III & IV,

Illustrating the Notice of Professor Max Schultze's paper on the Structure and Physiology of the Retina.

PLATE III.

Fig.

1.—Diagrammatic view of a section of the retina through the *macula lutea* and *fovea centralis* magnified about 110 diam.

i. The optic nerve layer.
h. Layer of ganglion-cells.
g. The molecular layer.
f. Inner granule layer.
a—d. Outer granule layer; the outer part of which contains the rod and cone granules, and the inner is almost entirely fibrous.
a. The membrana limitans externa.
b—c. Layer of "rods" and "cones."
p. Pigment.

The layers from *a* to *i* are accurately copied from a section through a normal human retina, whose relief, however, towards the vitreous humour was altered in consequence of the commencement of the formation of a *plica centralis*, which, as is well known, makes its appearance at the *macula lutea* very soon after death. But the figure, as it stands, represents the *macula lutea* without the *plica*, and, consequently, in the condition which it would present during life. The bacillary layer was also very well preserved in the same preparation, so that in this respect also the figure very fairly represents the natural condition; but the pigment was no longer attached to the percipient elements, and, consequently, in order to complete the figure, that part has been introduced from other preparations. Under these circumstances, also, the representation of the cones in the *fovea* as it is here given has, of course, been taken from other specimens. Although in the one first mentioned, as well as in several others, in which the central *plica* was already formed, it was possible to determine the increased length of the cones in the *fovea*, as compared with those in the immediate vicinity of it, still, owing to the absence of the pigmentary layer, no criterion was afforded of the absolute length of the cones in the living state. But this is afforded in the preparation represented in Fig. 2.

2.—Represents a section through the *macula lutea* and *fovea centralis*, taken from an eye hardened in Müller's fluid, and which had been extirpated in consequence of staphyloma. × 180 diam. and drawn with the *camera lucida*. Letters as above.

The inner layers of the retina are not represented in detail, as they were in a state of advanced atrophy. The cones were quite perfect, and remained in close connection with the pigmentary layer in which they were ensheathed at the choroidal extremity.

PLATE IV.

Diagrammatic representations of the two kinds of tissue of which the retina of mammals, and especially that of man, is composed. × about 500 diam.

Fig.

1.—The connective-tissue framework of the retina.

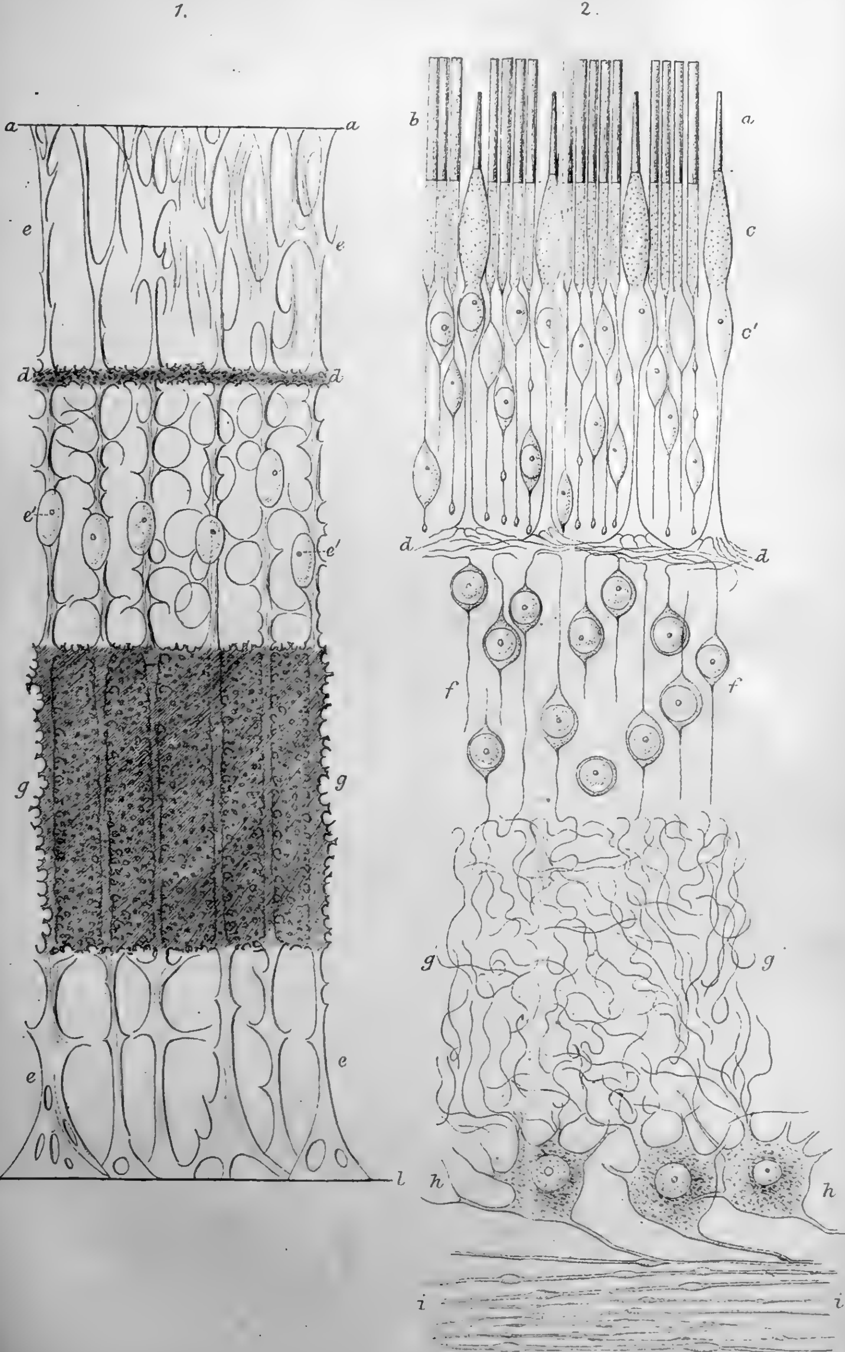
A, A. Membrana limitans externa.

e, e. Radial trabecular fibres, with their nuclei *e'*, *e'*.

l, l. M. limitans interna.

Coarser and finer membranous and fibrous bands connect the radial fibres together, especially in meridional lines, so that the retina may be split into foliaceous sections more readily in a meridional direction than in any other. The closed fibrous plexuses are those corresponding to the intergranular layer *d* and the molecular layer *g*.

2.—The nervous elements of the retina, commencing at the periphery with the rods *b* and the cones *c*, whose outer segments, however, do not appear to be continuous with the inner, but simply in a relation of contiguity. To these succeed the elements of the outer granule-layer, consisting of the rod- and cone-filaments; the latter furnished with nucleated enlargements *b'* and *c'*, corresponding with the granules. In the intergranular layer *d* may be noticed an inextricable plexus of extremely delicate nervous filaments, which are prolonged on the inner aspect into the radial nerve-fibres of the inner granule-layer, which are again furnished with nucleated enlargements, with respect to which it has not yet been determined whether they do not (at any rate, in mammals and man) contribute in one direction or another to the multiplication of the fibres. The straight radial direction of the nerve-fibres is next interrupted by a plexus of extremely delicate fibrillæ, which, together with that formed by the spongeiform connective tissue, constitute the molecular layer of the retina, which may be regarded as resembling the grey substance of the brain, and into which enter, from the inner aspect, the extremely fine ramifications of the processes of the ganglion-cells *h*, *h*, which, again, are in connection with the fibres of the optic-nerve-layer *i, i.* But, here, the possibility must be regarded, that some of the innumerable and excessively delicate fibrillæ of the optic nerve, which exist together with the coarser ones, in the optic-nerve layer of the retina, may not also enter the molecular layer, without the intervention of ganglion-cells.



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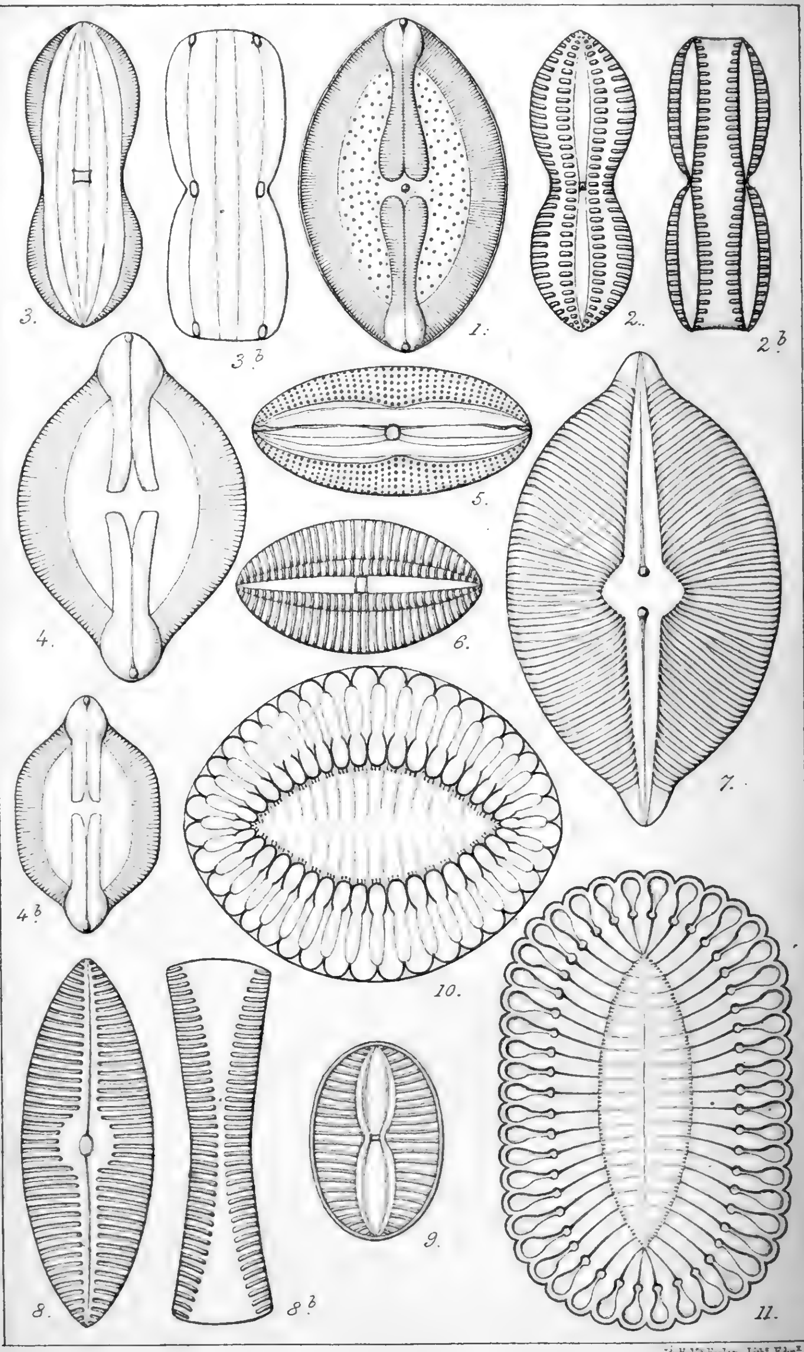


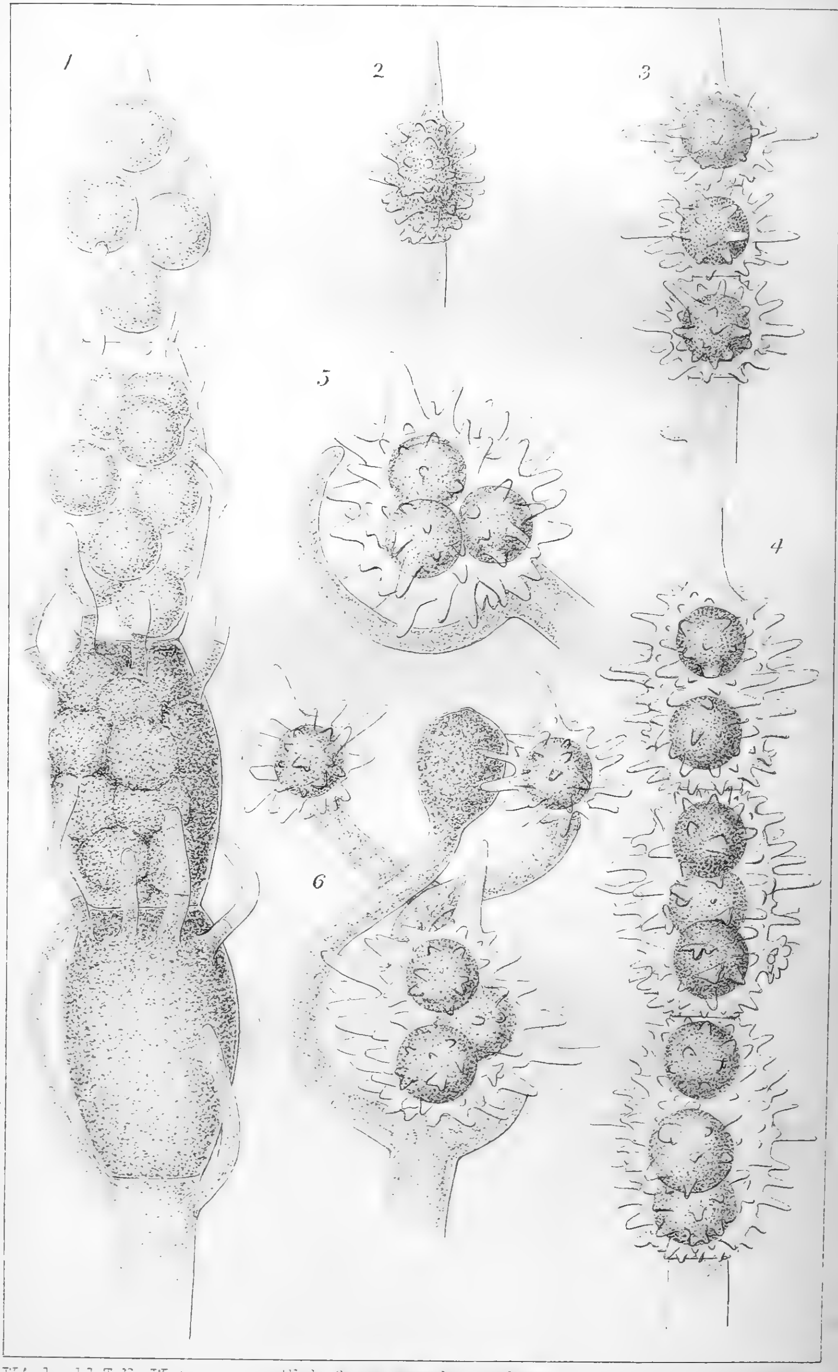
W. H. McFarlane, Lithr Edinr

DESCRIPTION OF PLATE V,

Illustrating Rev. Eugene O'Meara's paper on New Diatoms from Island of Arran, County Galway.

Fig.		
1.—*Nàvicula Hibernica.*		
2.— ,,	*denticulata.*	
2*b*.— ,,	,,	front view.
3.— ,,	*pellucida.*	
3*b*.— ,,	,,	front view.
4.— ,,	*Wrightii.*	
4*b*.— ,,	,,	variety of same.
5.— ,,	*amphoroides.*	
6.—*Pinnularia Arraniensis.*		
7.— ,,	*divaricata.*	
8.— ,,	*constricta.*	
8*b*.— ,,	,,	front view.
9.— ,,	*forficula.*	
10.—*Surirella pulcherrima.*		
11.— ,,	*gracilis.*	

All × 400.



W. Archer del. Tuffen West sc. All the figures magnified W. West imp.

DESCRIPTION OF PLATE VI,

Illustrating Mr. Archer's paper on Saprolegnieæ.

Fig.

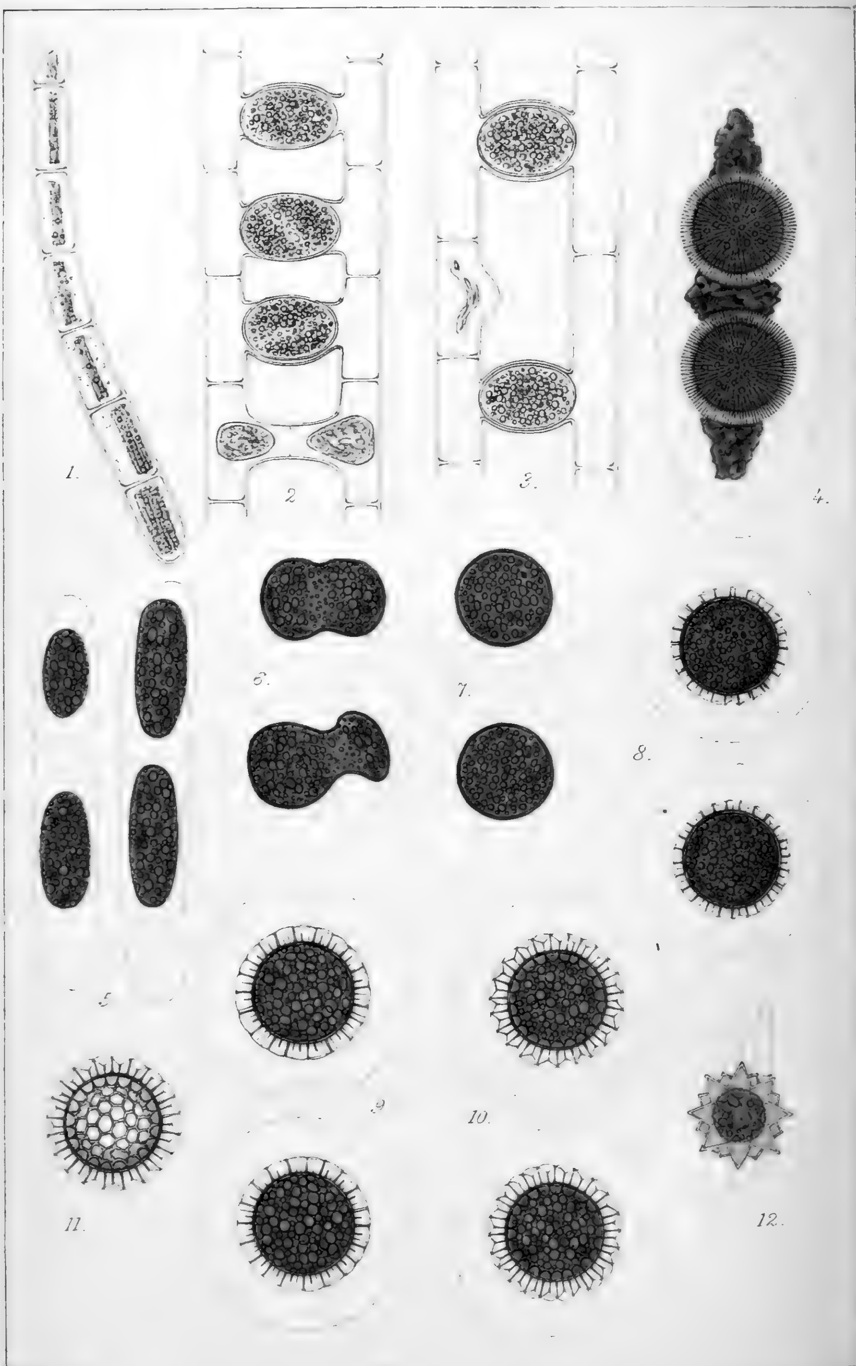
1.—Chain of four oogonia in *Saprolegnia androgyna*, sp. nov., showing the lateral male branchlets emanating from the oogonia; the two upper oogonia with fully formed oospores, the lowest but one showing the contents commencing to become formed into primordial cells (Befruchtungskugel, Pringsh.)—the future oospores; the lowest oogonium with the granular contents dense, but unchanged.

2.—A single terminal oogonium of *Achlya cornuta*, sp. nov.; its granular contents not yet commenced to be formed into a primordial cell or cells.

3 & 4.—Series of oogonia, the first smaller and with one oospore each, the latter larger, with a greater (variable) number; to right of middle oogonium is seen a curious depressed lobate form assumed by one of the extensions, instead of the usual tapering cornua.

5.—Shows the development of a lateral branch just under an oogonium; and—

6.—Three such branches, two of which have become shut off at their extremities and developed each an oogonium, each with a single oospore.



W. Archer, delt.

W.H. McFarlane, Lith. Edin.

DESCRIPTION OF PLATE VIII,

Illustrating Mr. W. Archer's papers on "Asteridia," on the Conjugation of Spirotænia, &c.

(All the figures × 300, except fig. 12 × 400.)

Fig.

1.—Sterile filament of a species of Mougeotia (de Bary, non Agardh) = *Zygogonium læve* (Kütz.) = *Mougeotia lævis* (Kütz.), Arch.

2.—Portion of a pair of conjugated filaments of same, showing the zygospores formed out of the total contents of each parent cell, and massed together in the inflated transverse tube, no septum shutting the latter off as a special chamber being formed.

3.—Portion of a pair of conjugated filaments of same.

4.—A cell of *Penium digitus* (Bréb.), containing two Asteridia, seemingly formed at the expense of a portion of the original contents of the Penium, the residue effete and brown coloured.

5.—Pair of cells of *Spirotænia condensata* about to conjugate, the contents of each formed into two elliptic masses.

6.—Conjugation advancing, the outer membrane of the pair of parent cells having disappeared.

7.—The pair of zygospores become round and smoothly defined.

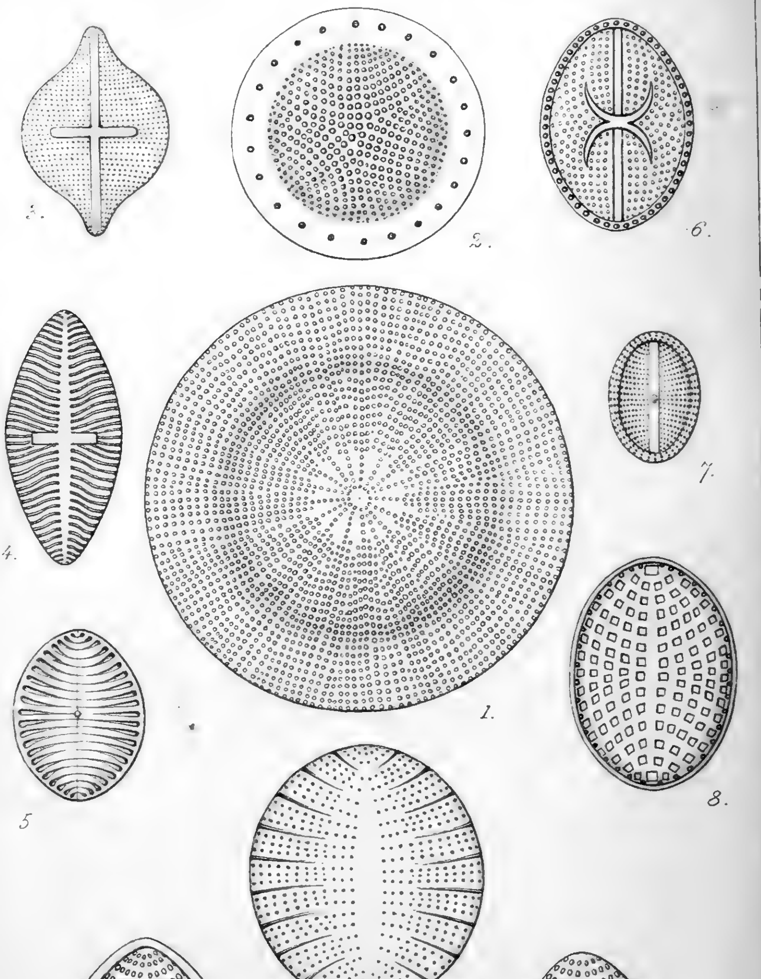
8.—The pair of zygospores, each showing the commencement of the "honeycomb"-like external structure, and each surrounded by mucus definitely bounded.

9.—A pair of zygospores fully formed, an optical section (or equator) in focus.

10.—The same focussed a little up.

11.—An empty zygospore to show the honeycomb external decoration.

12.—Zygospore of *Spirotænia truncata* (Arch.). (× 400.)



W. H. McFarlane Lith. Edin.

DESCRIPTION OF PLATE VII,

Illustrating Rev. Eugene O'Meara's second paper on New Diatoms from Island of Arran, Co. Galway.

Fig.

1.—*Coscinodiscus fasciculatus*, × 600.

2.—*Eupodiscus eccentricus*, × 800.

3.—*Stauroneis rhombica*, × 600.

4.— „ *costata*, × 600.

5.—*Cocconeis clavigera*, × 600.

6.— „ *Wrightii*, × 800.

7.— „ *Portii*, × 800.

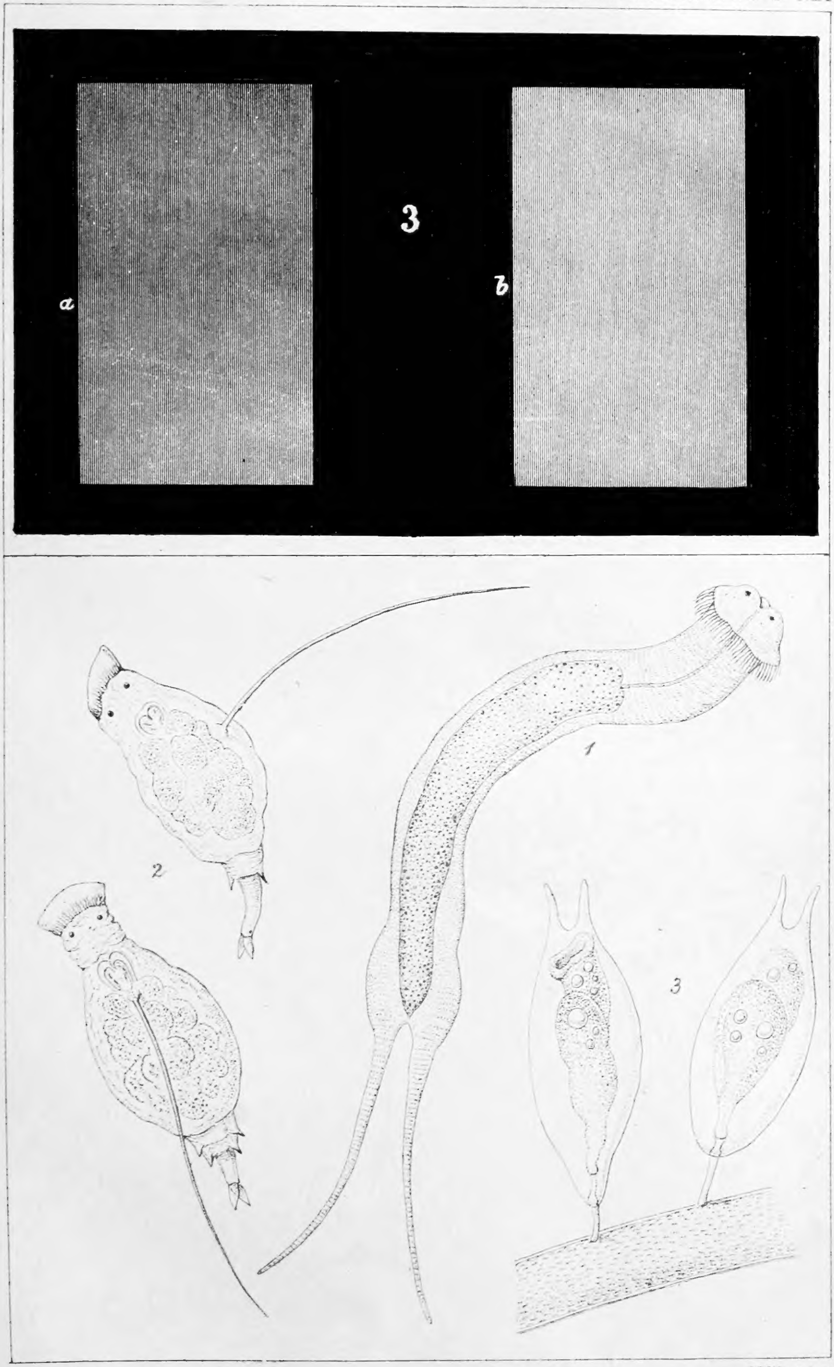
8.—*Rhaphoneis liburnica*, var., × 600.

9.— „ *suborbicularis*, × 600.

10.— „ *Jonesii*, × 600.

11.— „ *Moorii*, × 600.

12.— „ *Archeri*, × 600.



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